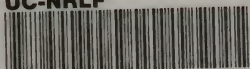


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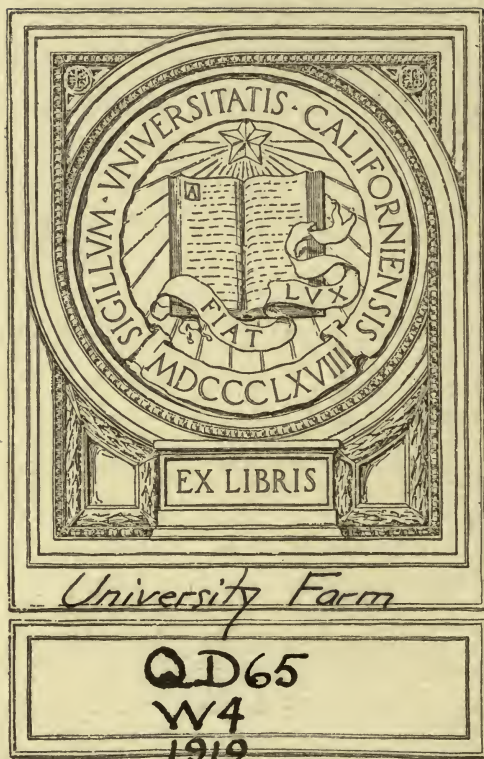
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CHEMICAL CALCULATION TABLES

HORACE L. WELLS



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CHEMICAL CALCULATION TABLES

FOR LABORATORY USE

BY

HORACE L. WELLS

*Professor of Analytical Chemistry and Metallurgy in the
Sheffield Scientific School of Yale University*

SECOND EDITION, REVISED

WITH

A DOUBLE THUMB-INDEXED
LOGARITHM TABLE



NEW YORK

JOHN WILEY & SONS, INC.

LONDON: CHAPMAN & HALL, LIMITED

1919

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Stanbope Press

F. H. GILSON COMPANY
BOSTON, U.S.A.

PREFACE

This book of tables for every day use in the chemical laboratory is a revision and modification of my "Tables for Chemical Calculations" published about 16 years ago, and now out of print. The changes in our official atomic weights have made necessary a complete revision of most of the tables. A new table for facilitating the calculation of percentage compositions of organic compounds has been added, while, in order to make the book more compact and thus more convenient for its chief uses, several of the smaller, less important tables have been omitted, while the matter relating to the explanation of the tables and the illustration of their uses has been either left out or much changed and abbreviated.

The table of logarithms of numbers has been provided with a double thumb-index which is believed to be a novel and useful device. With this improvement one can turn from any place in the table to any other reference, backward as well as forward, by practically a single motion, since all indices are visible from every part of the table.

The greatest care has been used to secure accuracy in the data by the duplication, at least, of their derivation, with a complete verification after the plates were cast.

There is no doubt that accurate calculation is exceedingly important in connection with quantitative analysis and other kinds of chemical work, and it is believed that these tables will be of assistance in avoiding errors of calculation, as well as in making the work more rapid and less laborious than is often the case.

H. L. W.

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CHEMICAL CALCULATION TABLES

INTRODUCTION

Five-place logarithms have been adopted in this book because they are satisfactory in usually introducing no inherent errors of calculation into the results obtained from the four-figure and five-figure numbers frequently used as data in chemical computations.

It is true that four-place logarithms will give amply accurate results for a great deal of analytical work, but as these are liable to give incorrect fourth figures in some cases the longer logarithms are to be preferred for general use. It is easy to use these with the conveniently indexed table here supplied, and they have the additional advantage that, since usually only four figures at the most are significant in the results of analytical work, these can be taken from the nearest logarithm without the trouble of interpolating for a fifth figure.

Computers should appreciate, and apply in carrying out their figures, the effects upon their results of the apparent errors of the approximate numbers employed. For general guidance in this matter the following rule may be given: Take as a basis the *smallest* number of apparently reliable figures in any of the approximate numbers used by multiplication and division (not including addition and subtraction) in producing the result. Then, if the number used for the basis begins with a smaller figure than does the result, the number of figures to be preserved in the result will usually be *equal to the basis*, while if the reverse is true in regard to the first figures the number of figures to be considered significant in the result will usually be *one more than the basis*. It should be borne in mind that zeros at the end of decimals may be apparently reliable. For example:

- a. $23.00 \text{ -- } \times 2.5417 \text{ -- } = 58.46 \text{ -- }$ (not 58.5 nor 58.459)
b. $0.0089 \text{ -- } \times 0.16598 \text{ -- } = 0.00148 \text{ -- }$ (not 0.0015 nor 0.001475)
c. $0.2301 \text{ -- } \div 2.5600 \text{ -- } = 0.08988 \text{ -- }$ (not 0.0899 nor 0.89883)
d. $\frac{0.0018 \text{ g} \times 0.8034 \text{ (factor)} \times 100}{1.6500 \text{ g (substance)}} = 0.088\%$ (not 0.0876%)

This rule is by no means an absolute one, and it should be modified according to judgment. For instance, in the example *d* given above, since 88 is so much larger than the 18 from which it is derived, it might well be preferred to call the result 0.09%. In some cases it is desirable to preserve a very uncertain last figure, while in other instances it is best to omit it, but it is very bad practice to report more than one evidently uncertain figure, or to leave off or fail to calculate one or more apparently accurate ones. Attention may be called here to the importance of adding a unit to the preceding figure when a figure greater than 5 is left off.

For a more extensive discussion of the use of approximate numbers in calculations, the author's "Text Book of Chemical Arithmetic" may be referred to.

In order that accidental errors of calculation may be avoided it is recommended that entirely independent duplications of all calculations should be carried out, for mistakes are not always discovered by simply looking over the work.

In Tables II and III the logarithms are generally given, for the sake of uniformity, as though the atomic weights were exact, instead of approximate, numbers. For instance, a five-place logarithm is given for the atomic weight of boron, 11.0-- , just as though it were known to be 11.000. This feature need cause no trouble as far as the gravimetric factors are concerned, since the latter are practically always more accurate than the data to which they are applied, and hence they need not be considered in deciding upon the significant figures of the results of ordinary calculations.

The numerical formula weights in Table III in some cases have an uncertain last figure.

	Hg	200.6
For example, in the addition	S	32.06
		<u>232.66</u>

the last figure in the sum is uncertain because it has been obtained by addition to an unknown (plus or minus) figure. It has been preferred in most cases to retain such uncertain figures, since leaving them off and giving, for instance, HgS as 232.7 would be liable to decrease the accuracy of such formula-weights. In using these numbers for calculations it will usually make no difference whether or not the final figures are apparently accurate, but a glance at the atomic weights will show which is the case.

The student should observe that many of the numerical factors in Table II, when multiplied by 100, give percentages of constituents, and that they may often be conveniently used in this way. For example, $\text{NaCl} \rightarrow \text{Na} = 0.39444$ shows that NaCl contains 39.44% of Na and 60.56% of Cl. Since the factor 0.39444 is derived from 23.00-- , its last figure is uncertain and has not been used in giving the percentages (compare the rule previously given).

It should be stated that the value 0.0012510 g. was adopted in Table VI as the weight of 1 cc. of nitrogen gas at 41° latitude, instead of the value 0.0012514 g. at 45° because the former latitude is more suitable for general reference in the United States, but that the change makes a difference of only about one part in 3000 and is entirely inappreciable in nitrogen determinations by the Dumas method.

TABLE I.
ATOMIC WEIGHTS.*
O = 16.

Aluminium.....	Al	27.1	Neodymium.....	Nd	144.3
Antimony.....	Sb	120.2	Neon.....	Ne	20.2
Argon.....	A	39.88	Nickel.....	Ni	58.68
Arsenic.....	As	74.96	Niobium (Columbium).. <td>Nb</td> <td>93.1</td>	Nb	93.1
Barium.....	Ba	137.37	Niton.....	Nt	222.4
Beryllium (Glucinum)...	Be	9.1	Nitrogen.....	N	14.01
Bismuth.....	Bi	208.0	Osmium.....	Os	190.9
Boron.....	B	11.0	Oxygen.....	O	16.00
Bromine.....	Br	79.92	Palladium.....	Pd	106.7
Cadmium.....	Cd	112.40	Phosphorus.....	P	31.04
Cæsium.....	Cs	132.81	Platinum.....	Pt	195.2
Calcium.....	Ca	40.07	Potassium.....	K	39.10
Carbon.....	C	12.005	Praseodymium.....	Pr	140.9
Cerium.....	Ce	140.25	Radium.....	Ra	226.0
Chlorine.....	Cl	35.46	Rhodium.....	Rh	102.9
Chromium.....	Cr	52.0	Rubidium.....	Rb	85.45
Cobalt.....	Co	58.97	Ruthenium.....	Ru	101.7
Copper.....	Cu	63.57	Samarium.....	Sm	150.4
Dysprosium.....	Dy	162.5	Scandium.....	Sc	44.1
Erbium.....	Er	167.7	Selenium.....	Se	79.2
Europium.....	Eu	152.0	Silicon.....	Si	28.3
Fluorine.....	F	19.0	Silver.....	Ag	107.88
Gadolinium.....	Gd	157.3	Sodium.....	Na	23.00
Gallium.....	Ga	69.9	Strontium.....	Sr	87.63
Germanium.....	Ge	72.5	Sulphur.....	S	32.06
Gold.....	Au	197.2	Tantalum.....	Ta	181.5
Helium.....	He	4.00	Tellurium.....	Te	127.5
Holmium.....	Ho	163.5	Terbium.....	Tb	159.2
Hydrogen.....	H	1.008	Thallium.....	Tl	204.0
Indium.....	In	114.8	Thorium.....	Th	232.4
Iodine.....	I	126.92	Thulium.....	Tm	168.5
Iridium.....	Ir	193.1	Tin.....	Sn	118.7
Iron.....	Fe	55.84	Titanium.....	Ti	48.1
Krypton.....	Kr	82.92	Tungsten.....	W	184.0
Lanthanum.....	La	139.0	Uranium.....	U	238.2
Lead.....	Pb	207.20	Vanadium.....	V	51.0
Lithium.....	Li	6.94	Xenon.....	X	130.2
Lutecium.....	Lu	175.0	Ytterbium.....	Yb	173.5
Magnesium.....	Mg	24.32	Yttrium.....	Yt	88.7
Manganese.....	Mn	54.93	Zinc.....	Zn	65.37
Mercury.....	Hg	200.6	Zirconium.....	Zr	90.6
Molybdenum.....	Mo	96.0			

* This is the latest International Table.

GRAVIMETRIC FACTORS

TABLE II.
GRAVIMETRIC FACTORS.

	Given.	Sought.	Multiply by Factor.	
			N.	Log.
Aluminium, 27.1	Al_2O_3	Al_2	.5303	.72 455
	Al_2	Al_2O_3	1.886	.27 545
	AlPO_4	$(\frac{1}{2})\text{Al}_2\text{O}_3$	.4184	.62 156
Antimony, 120.2	Sb_2O_4	Sb_2	.7898	.89 749
	Sb_2O_4	Sb_2O_3	.9475	.97 656
	Sb_2O_4	Sb_2O_5	1.0526	.02 225
	Sb_2S_3	Sb_2	.7142	.85 384
	Sb_2S_3	Sb_2O_3	.8569	.93 291
	Sb_2S_3	Sb_2O_5	.9519	.97 860
	Sb_2	Sb_2O_3	1.1997	.07 907
	Sb_2	Sb_2O_5	1.3328	.12 476
	As_2S_3	As_2	.6092	.78 475
		As_2O_3	.8042	.90 538
Arsenic, 74.96	As_2S_3	As_2O_5	.9343	.97 047
	As_2S_3	$(2)\text{AsO}_4$	1.1293	.05 281
	As_2S_5	As_2	.4833	.68 419
	$\text{Mg}_2\text{As}_2\text{O}_7$	As_2	.4827	.68 372
	$\text{Mg}_2\text{As}_2\text{O}_7$	As_2O_3	.6373	.80 435
	$\text{Mg}_2\text{As}_2\text{O}_7$	As_2O_5	.7403	.86 944
	$\text{Mg}_2\text{As}_2\text{O}_7$	$(2)\text{AsO}_4$	.8949	.95 178
	Ag_3AsO_4	As	.1620	.20 962
	As_2	As_2O_3	1.3202	.12 063
	As_2	As_2O_5	1.5336	.18 572
	BaSO_4	Ba	.5885	.76 973
		BaO	.6570	.81 758
		Ba	.5422	.73 413
	BaCrO_4	BaO	.6053	.78 198
	BaCO_3	Ba	.6960	.84 260
	BaCO_3	BaO	.7770	.89 045
	Ba	BaO	1.1165	.04 785
Bismuth, 208.0	Bi_2O_3	Bi_2	.8965	.95 257
	BiOCl	Bi	.8017	.90 399
	BiOCl	$(\frac{1}{2})\text{Bi}_2\text{O}_3$	.8942	.95 142

	Given.	Sought.	Multiply by Factor.	
			N.	Log.
	Bi_2S_3	Bi_2	.8122	.90 967
	Bi_2S_3	Bi_2O_3	.9059	.95 710
	Bi_2	Bi_2O_3	1.1154	.04 743
Boron, 11.0	B_2O_3	B_2	.3143	.49 732
	B_2	B_2O_3	3.182	.50 268
Bromine, 79.92	AgBr	Br	.42556	.62 896
	AgBr	HBr	.43092	.63 440
	$\text{Br}-\text{Cl}$	Br	1.7976	.25 469
	$\text{Br}-\text{Cl}$	AgBr	4.2241	.62 573
	Br	$(\frac{1}{2})\text{O}$	.1001	.00 043
Cadmium, 112.40	CdO	Cd	.8754	.94 220
	CdS	Cd	.7781	.89 102
	CdS	CdO	.8888	.94 882
	Cd	CdO	1.1424	.05 780
Cæsium, 132.81	Cs_2SO_4	Cs_2	.7344	.86 593
	Cs_2PtCl_6	Cs_2	.3943	.59 587
	Cs_2	Cs_2O	1.0602	.02 540
Calcium, 40.07	CaO	Ca	.71465	.85 409
	CaO	CaCO_3	1.7848	.25 159
	CaSO_4	Ca	.2944	.46 886
	CaSO_4	CaO	.4119	.61 477
	CaCO_3	Ca	.4004	.60 250
	CaCO_3	CaO	.5603	.74 840
	Ca	CaO	1.3993	.14 591
	Ca	CaCO_3	2.4975	.39 750
	CaO	CaSO_4	2.4279	.38 523
Carbon, 12.005	BaCO_3	CO_2	.2229	.34 820
	CaCO_3	CO_2	.4397	.64 318
	CO_2	C	.2728	.43 586
	C	CO_2	3.6656	.56 414
	CO_2	CO_3	1.3636	.13 468
Chlorine, 35.46	AgCl	Cl	.24738	.39 337
	AgCl	HCl	.2544	.40 555
	Ag	Cl	.3287	.51 680
	Cl	$(\frac{1}{2})\text{O}$	.2256	.35 335
	AgCl	$(\frac{1}{2})\text{O}$	.05581	.74 672

	Given.	Sought.	Multiply by Factor.	
			N.	Log.
Chromium, 52.0	Cr_2O_3	Cr_2	.6842	.83 519
	Cr_2O_3	(2) CrO_3	1.3158	.11 919
	PbCrO_4	Cr	.1609	.20 653
	PbCrO_4	($\frac{1}{2}$) Cr_2O_3	.2351	.37 134
	PbCrO_4	CrO_3	.3094	.49 053
	Cr_2	Cr_2O_3	1.462	.16 481
Cobalt, 58.97	Cr	CrO_3	1.923	.28 400
	CoSO_4	Co	.3804	.58 022
	Co_3O_4	Co_3	.7343	.86 589
Copper, 63.57	Co	CoO	1.2713	.10 426
	CuO	Cu	.7989	.90 250
	Cu	CuO	1.2517	.09 750
	Cu_2S	Cu_2	.7986	.90 234
	Cu_2S	(2) CuO	.9996	.99 984
	CuSCN	Cu	.5226	.71 815
Cyanogen, 26.015	CuSCN	CuO	.6541	.81 565
	AgCN	CN	.1943	.28 846
	Ag	CN	.2411	.38 228
Fluorine, 19.0	CaF_2	F_2	.4867	.68 730
	SiF_4	F_4	.7287	.86 253
Hydrogen, 1.008	H_2O	H_2	.1119	.04 884
Iodine, 126.92	AgI	I	.5405	.73 283
	PdI_2	I_2	.7041	.84 760
	I—Cl	I	1.3877	.14 230
Iron, 55.84	I—Cl	AgI	2.5672	.40 947
	Fe_2O_3	Fe_2	.6994	.84 473
	Fe_2O_3	(2) FeO	.8998	.95 415
	Fe_2O_3	(2) FeS_2	1.5025	.17 682
	FeS	Fe	.6353	.80 296
	Fe	FeO	1.2865	.10 942
Lead, 207.20	Fe_2	Fe_2O_3	1.4298	.15 527
	PbSO_4	Pb	.6833	.83 458
	PbSO_4	PbO	.7360	.86 688
	PbSO_4	PbS	.7890	.89 706
	PbCrO_4	Pb	.6411	.80 692
	PbCrO_4	PbO	.6906	.83 922

	Given.	Sought.	Multiply by Factor.	
			N.	Log.
Lithium, 6.94	PbS	Pb	.8660	.93 752
	PbS	PbO	.9329	.96 982
	PbCl ₂	Pb	.7450	.87 216
	PbO	Pb	.9283	.96 770
	Pb	PbO	1.0772	.03 230
	Li ₂ SO ₄	Li ₂	.1263	.10 123
	Li ₂ SO ₄	Li ₂ O	.2718	.43 422
	Li ₃ PO ₄	Li ₃	.1797	.25 455
	Li ₂	Li ₂ O	2.153	.33 299
Magnesium, 24.32	Mg ₂ P ₂ O ₇	Mg ₂	.2184	.33 923
	Mg ₂ P ₂ O ₇	(2)MgO	.3621	.55 879
	Mg ₂ P ₂ O ₇	(2)MgCO ₃	.7572	.87 923
	MgSO ₄	Mg	.2020	.30 541
	MgSO ₄	MgO	.3349	.52 497
	MgO	Mg	.6032	.78 044
	MgO	MgCO ₃	2.0914	.32 044
	Mg	MgO	1.6579	.21 956
	Mn ₂ P ₂ O ₇	Mn ₂	.3869	.58 761
Manganese, 54.93	Mn ₂ P ₂ O ₇	(2)MnO	.4996	.69 863
	Mn ₃ O ₄	(3)Mn	.7203	.85 749
	Mn ₃ O ₄	(3)MnO	.9301	.96 851
	MnS	Mn	.6315	.80 034
	MnS	MnO	.8154	.91 136
	MnSO ₄	Mn	.3638	.56 086
	MnSO ₄	MnO	.4698	.67 188
	MnO	MnO ₂	1.2256	.08 834
	Mn	MnO	1.2913	.11 102
Mercury, 200.6	Mn	MnO ₂	1.5826	.19 936
	HgS	Hg	.8622	.93 561
	HgS	HgO	.9310	.96 894
	HgCl	Hg	.8498	.92 931
	HgCl	HgO	.9176	.96 264
	Hg	HgO	1.0798	.03 333
Molybdenum, 96.0	MoO ₃	Mo	.6667	.82 391
	PbMoO ₄	MoO ₃	.3922	.59 346
Nickel, 58.68	NiSO ₄	Ni	.3792	.57 889

		Multiply by Factor.	
		N.	Log.
Nitrogen, 14.01	Given.	Sought.	
	NiO	Ni	.7858
	Ni	NiO	1.2727
	NH ₄ Cl	N	.2619
	NH ₄ Cl	NH ₃	.3184
	NH ₄ Cl	NH ₄	.3372
	(NH ₄) ₂ PtCl ₆	(2)N	.06310
	(NH ₄) ₂ PtCl ₆	(2)NH ₃	.07672
	(NH ₄) ₂ PtCl ₆	(2)NH ₄	.08126
	(NH ₄) ₂ PtCl ₆	(2)NH ₄ Cl	.2410
	Pt	(2)N	.1435
	Pt	(2)NH ₃	.1745
	Pt	(2)NH ₄	.1849
	N	NH ₃	1.216
	NH ₃	N	.8225
Phosphorus, 31.04	N	($\frac{1}{2}$)(NH ₄) ₂ O	1.859
	N	($\frac{1}{2}$)(NH ₄) ₂ SO ₄	4.716
	N	($\frac{1}{2}$)N ₂ O ₅	3.855
	N	NO ₃	4.426
	N	NO ₂	3.284
	N	NO	2.142
	Mg ₂ P ₂ O ₇	P ₂	.2787
	Mg ₂ P ₂ O ₇	P ₂ O ₅	.6379
	Mg ₂ P ₂ O ₇	(2)PO ₄	.8534
	FePO ₄	($\frac{1}{2}$)P ₂ O ₅	.4708
	U ₂ P ₂ O ₁₁	P ₂ O ₅	.1989
	P ₂ O ₅	P ₂	.4369
	P ₂	P ₂ O ₅	2.289
	(NH ₄) ₂ PtCl ₆	Pt	.4396
	KCl	K	.52441
Potassium, 39.10	KCl	($\frac{1}{2}$)K ₂ O	.63170
	K ₂ SO ₄	K ₂	.44876
	K ₂ SO ₄	K ₂ O	.54056
	K ₂ PtCl ₆	K ₂	.1609
	K ₂ PtCl ₆	K ₂ O	.1938
	K ₂ PtCl ₆	(2)KCl	.3067
	KClO ₄	K	.2822
			.45 054

		Multiply by Factor.	
		N.	Log.
	Given.	Sought.	
	KClO ₄	($\frac{1}{2}$)K ₂ O	.3399
	KClO ₄	KCl	.5381
	K	($\frac{1}{2}$)K ₂ O	1.2046
			.08 084
Rubidium, 85.45	Rb ₂ SO ₄	Rb ₂	.6402
	Rb ₂ PtCl ₆	Rb ₂	.2952
	Rb	($\frac{1}{2}$)Rb ₂ O	1.0936
			.80 629
			.47 017
			.03 887
Selenium, 79.2	Se	SeO ₂	1.4040
	Se	SeO ₃	1.6060
Silicon, 28.3	SiO ₂	Si	.4693
			.67 147
	SiO ₂	SiO ₃	1.265
	SiO ₂	($\frac{1}{2}$)Si ₂ O ₇	1.398
	SiO ₂	SiO ₄	1.531
			.10 220
			.14 551
			.18 488
Silver, 107.88	Si	SiO ₂	2.131
	AgCl	Ag	.75262
	AgCl	($\frac{1}{2}$)Ag ₂ O	.80842
			.32 853
			.87 657
			.90 764
	AgBr	Ag	.57444
	AgI	Ag	.45945
	Ag ₂	Ag ₂ O	1.0742
			.75 924
			.66 224
			.03 107
Sodium, 23.00	NaCl	Na	.39344
	NaCl	($\frac{1}{2}$)Na ₂ O	.53028
	Na ₂ SO ₄	Na ₂	.32381
			.59 487
			.72 450
			.51 029
	Na ₂ SO ₄	Na ₂ O	.43644
	Na ₂ CO ₃	Na ₂	.43394
	Na ₂ CO ₃	Na ₂ O	.58487
			.63 992
			.63 743
			.76 706
Strontium, 87.63	Na	($\frac{1}{2}$)Na ₂ O	1.3478
	SrSO ₄	Sr	.4770
	SrSO ₄	SrO	.5642
			.12 963
			.67 856
			.75 140
	SrCO ₃	Sr	.5936
	SrCO ₃	SrO	.7019
	Sr	SrO	1.1826
			.77 346
			.84 630
			.07 284
Sulphur, 32.06	BaSO ₄	S	.13734
	BaSO ₄	SO ₂	.27443
	BaSO ₄	SO ₃	.34298
			.13 780
			.43 843
			.53 526
	BaSO ₄	SO ₄	.41151
	BaSO ₄	H ₂ SO ₄	.42015
	S	SO ₂	1.9981
			.61 438
			.62 340
			.30 063

	Given.	Sought.	Multiply by Factor.	
			N.	Log.
Tellurium, 127.5	S	SO ₃	2.4972	.39 746
	S	H ₂ SO ₄	3.0591	.48 560
	Te	TeO ₂	1.2510	.09 725
Thallium, 204.0	Te	TeO ₃	1.3765	.13 877
	TlI	Tl	.6165	.78 990
	Tl ₂ PtCl ₆	Tl ₂	.5000	.69 899
Thorium, 232.4	Tl ₂	Tl ₂ O	1.0392	.01 671
	ThO ₂	Th	.8790	.94 398
Tin, 118.7	SnO ₂	Sn	.7877	.89 634
Titanium, 48.1	Sn	SnO ₂	1.2696	.10 366
	TiO ₂	Ti	.6005	.77 852
Tungsten, 184.0	WO ₃	W	.7931	.89 933
Uranium, 238.2	U ₃ O ₈	U ₃	.8481	.92 844
	U ₃ O ₈	(3)UO ₂	.9620	.98 319
Vanadium, 51.0	V ₂ O ₅	V ₂	.5604	.74 853
	V ₂	V ₂ O ₅	1.784	.25 147
	V	VO ₄	2.255	.35 313
Zinc, 65.37	ZnO	Zn	.8034	.90 492
	ZnS	Zn	.6710	.82 669
	ZnS	ZnO	.8352	.92 177
	Zn ₂ P ₂ O ₇	Zn ₂	.4289	.63 237
	Zn ₂ P ₂ O ₇	(2)ZnO	.5339	.72 745
	Zn	ZnO	1.2447	.09 508
Zirconium, 90.6	ZrO ₂	Zr	.7390	.86 864

TABLE III.
FORMULA = WEIGHTS

Formula.	Weight.	Log.	Formula.	Weight.	Log.
Ag	107.88	.03 294	B	11.0	.04 139
Ag ₂	215.76	.33 397	B ₂	22.0	.34 242
Ag ₃	323.64	.51 007	B ₂ O ₃	70.0	.84 510
Ag ₃ AsO ₄	462.60	.66 521	Ba	137.37	.13 789
AgBr	187.80	.27 370	BaCO ₃	197.375	.29 530
AgCN	133.895	.12 676	BaCl ₂	208.29	.31 867
AgCl	143.34	.15 637	BaCl ₂ ·2H ₂ O	244.32	.38 796
AgI	234.80	.37 070	BaCrO ₄	253.37	.40 376
AgIO ₃	282.80	.45 148	Ba(NO ₃) ₂	261.39	.41 729
AgNO ₃	169.89	.23 017	BaO	153.37	.18 574
Ag ₂ O	231.76	.36 504	BaO ₂	169.37	.22 884
$\frac{1}{2}$ Ag ₂ O	115.88	.06 401	BaO ₂ ·8H ₂ O	313.50	.49 624
Ag ₃ PO ₄	418.68	.62 188	Ba(OH) ₂ ·8H ₂ O	315.51	.49 901
Ag ₂ S	247.82	.39 414	BaSO ₄	233.43	.36 816
Al	27.1	.43 297	Be	9.1	.95 904
Al ₂	54.2	.73 400	BeO	25.1	.39 967
AlCl ₃	133.48	.12 542	Bi	208.0	.31 806
AlCl ₃ ·6H ₂ O	241.58	.38 306	Bi ₂	416.0	.61 909
AlK(SO ₄) ₂ ·12H ₂ O	474.51	.67 625	Bi ₂ O ₃	464.0	.66 652
AlNH ₄ (SO ₄) ₂ ·12H ₂ O	453.45	.65 653	$\frac{1}{2}$ Bi ₂ O ₃	232.0	.36 549
AlNa ₃ F ₆	210.10	.32 243	BiOCl	259.46	.41 407
Al ₂ O ₃	102.2	.00 945	Bi(OH) ₂ NO ₃	304.03	.48 291
$\frac{1}{2}$ Al ₂ O ₃	51.1	.70 842	Bi ₂ S ₃	512.18	.70 942
AlPO ₄	122.14	.08 686	Br	79.92	.90 266
Al ₂ (SO ₄) ₃	342.38	.53 451	Br ₂	159.84	.20 369
Al ₂ (SO ₄) ₃ ·18H ₂ O	666.67	.82 391	Br ₃	239.76	.37 978
As	74.96	.87 483	Br ₄	319.68	.50 472
As ₂	149.92	.17 586	Br ₅	399.60	.60 163
AsCl ₃	181.34	.25 850	Br ₆	479.52	.68 081
As ₂ O ₃	197.92	.29 649	C	12.005	.07 936
$\frac{1}{2}$ As ₂ O ₃	98.96	.99 546	C ₂	24.01	.38 039
$\frac{1}{4}$ As ₂ O ₃	49.48	.69 443	CH ₃	15.03	.17 696
As ₂ O ₅	229.92	.36 158	CH ₄	16.04	.20 520
$\frac{1}{2}$ As ₂ O ₅	114.96	.06 055	C ₂ H ₂	26.03	.41 547
AsO ₄	138.96	.14 289	C ₂ H ₅	29.05	.46 315
As ₂ O ₃	277.92	.44 392	C ₆ H ₆	78.08	.89 254
As ₂ S ₃	246.10	.39 111			
As ₂ S ₅	310.22	.49 167			
Au	197.2	.29 491			
AuCl ₃ ·2H ₂ O	339.61	.53 098			

Formula.	Weight.	Log.	Formula.	Weight.	Log.
$C_2H_3O_2$	59.03	.77 107	ClO_3	83.46	.92 148
$C_4H_4O_6$	148.05	.17 041	ClO_4	99.46	.99 765
CN	26.015	.41 522	Cl_2O_5	150.92	.17 875
CNS	58.08	.76 403	Cl_2O_7	182.92	.26 226
CO	28.005	.44 724	Co	58.97	.77 063
CO_2	44.005	.64 350	$CoCl_2 \cdot 6H_2O$	237.99	.37 656
CO_3	60.005	.77 818	$Co(NO_3)_2 \cdot 6H_2O$	291.09	.46 402
C_2O_4	88.01	.94 453	CoO	74.97	.87 489
CON_2H_4	60.06	.77 859	Co_3O_4	240.91	.38 186
CS_2	76.13	.88 156	$CoSO_4$	155.03	.19 041
Ca	40.07	.60 282	$CoSO_4 \cdot 7H_2O$	281.14	.44 892
CaC_2	64.08	.80 672	Cr	52.0	.71 600
$CaCO_3$	100.08	.00 035	Cr_2	104.0	.01 703
$CaCl_2$	110.99	.04 528	Cr_2O_3	152.0	.18 184
$CaCl_2 \cdot 6H_2O$	219.09	.34 062	CrO_3	100.0	.00 000
$CaCl_2O$	126.99	.10 377	CrO_4	116.0	.06 446
CaF_2	78.07	.89 248	Cr_2O_7	216.0	.33 445
CaO	56.07	.74 873	Cs	132.81	.12 323
$Ca(OH)_2$	74.09	.86 976	Cs_2	265.62	.42 426
$Ca_3(PO_4)_2$	310.29	.49 177	$CsAl(SO_4)_2 \cdot 12H_2O$	568.22	.75 452
$CaSO_4$	136.13	.13 396	$CsCl$	168.27	.22 601
$CaSO_4 \cdot 2H_2O$	172.16	.23 593	Cs_2O	281.62	.44 966
$CaSiO_3$	116.37	.06 584	Cs_2PtCl_6	673.58	.82 839
Cd	112.40	.05 077	Cs_2SO_4	361.68	.55 833
$CdCO_3$	172.41	.23 657	Cu	63.57	.80 325
$CdCl_2 \cdot 2H_2O$	219.35	.34 114	Cu_2	127.14	.10 428
$Cd(NO_3)_2 \cdot 4H_2O$	308.48	.48 922	CuCl	99.03	.99 577
CdO	128.40	.10 857	$CuCl_2$	134.49	.12 869
CdS	144.46	.15 975	$CuCl_2 \cdot 2H_2O$	170.52	.23 177
$CdSO_4$	208.46	.31 903	CuI	190.49	.27 987
$CdSO_4 \cdot 2\frac{2}{3}H_2O$	256.50	.40 909	$CuFeS_2$	183.53	.26 371
Ce	140.25	.14 690	$Cu(NO_3)_2 \cdot 6H_2O$	295.69	.47 083
Ce_2O_3	328.50	.51 654	CuO	79.57	.90 075
CeO_2	172.25	.23 616	Cu_2O	143.14	.15 576
Cl	35.46	.54 974	Cu_2S	159.20	.20 194
Cl_2	70.92	.85 077	CuSCN	121.65	.08 511
Cl_3	106.38	.02 686	$CuSO_4$	159.63	.20 311
Cl_4	141.84	.15 180	$CuSO_4 \cdot 5H_2O$	249.71	.39 744
Cl_5	177.30	.24 871	Fe	55.84	.74 695
Cl_6	212.76	.32 789	Fe_2	111.68	.04 798
ClO	51.46	.71 147			

Formula.	Weight.	Log.	Formula.	Weight.	Log.
Fe ₃	167.52	.22 406	Hg	200.6	.30 233
FeCO ₃	115.85	.06 390	Hg(CN) ₂	252.63	.40 248
FeCl ₃	162.22	.21 010	HgCl	236.06	.37 302
FeCl ₃ ·6H ₂ O	270.32	.43 188	HgCl ₂	271.52	.43 380
Fe(NH ₄) ₂ (SO ₄) ₂ ·6H ₂ O	392.14	.59 344	HgI ₂	454.44	.65 748
FeNH ₄ (SO ₄) ₂ ·12H ₂ O	482.19	.68 322	HgO	216.6	.33 566
FeO	71.84	.85 637	HgS	232.66	.36 672
Fe ₂ O ₃	159.68	.20 325	I	126.92	.10 353
$\frac{1}{2}$ Fe ₂ O ₃	79.84	.90 222	I ₂	253.84	.40 456
Fe ₃ O ₄	231.52	.36 459	I ₃	380.76	.58 065
FeS	87.90	.94 399	I ₄	507.68	.70 559
FeS ₂	119.96	.07 904	I ₅	634.60	.80 250
FeSO ₄ ·7H ₂ O	278.01	.44 406	I ₆	761.52	.88 168
H	1.008	.00 346	I ₂ O ₅	333.84	.52 354
H ₂	2.016	.30 449	IO ₃	174.92	.24 284
H ₃	3.024	.48 058	IO ₄	190.92	.28 085
H ₄	4.032	.60 552	K	39.10	.59 218
H ₅	5.040	.70 243	K ₂	78.20	.89 321
H ₆	6.048	.78 161	K ₃	117.30	.06 930
H ₃ BO ₃	62.02	.79 253	K ₄	156.40	.19 424
HBr	80.93	.90 811	KAl(SO ₄) ₂ ·12H ₂ O	474.51	.67 625
HC ₂ H ₃ O ₂	60.04	.77 844	KBr	119.02	.07 562
HCN	27.023	.43 174	KBrO ₃	167.02	.22 277
HCO ₂ H	46.02	.66 295	KCN	65.12	.81 371
H ₂ C ₂ O ₄	90.03	.95 439	K ₂ CO ₃	138.21	.14 054
H ₂ C ₂ O ₄ ·2H ₂ O	126.06	.10 058	KCl	74.56	.87 251
$\frac{1}{2}$ [H ₂ C ₂ O ₄ ·2H ₂ O]	63.03	.79 955	2KCl	149.12	.17 354
H ₂ C ₄ H ₄ O ₆	150.07	.17 629	KClO ₃	122.56	.08 835
HCl	36.468	.56 192	KClO ₄	138.56	.14 164
HClO ₄	100.47	.00 204	K ₂ CrO ₄	194.20	.28 825
HF	20.01	.30 125	K ₂ Cr ₂ O ₇	294.20	.46 864
HI	127.93	.10 697	$\frac{1}{6}$ K ₂ CrO ₇	49.033	.69 049
HKCO ₃	100.11	.00 048	KCr(SO ₄) ₂ ·12H ₂ O	499.41	.69 846
HNO ₃	63.02	.79 948	K ₃ Fe(CN) ₆	329.23	.51 750
HNaCO ₃	84.01	.92 433	K ₄ Fe(CN) ₆	368.33	.56 624
HN ₂ PO ₄ ·12H ₂ O	358.24	.55 418	K ₄ Fe(CN) ₆ ·3H ₂ O	422.38	.62 570
HO	17.008	.23 065	KHCO ₃	100.11	.00 048
H ₂ O	18.016	.25 565	KI	166.02	.22 016
H ₂ O ₂	34.02	.53 173	KIO ₃	214.02	.33 045
H ₃ PO ₄	98.06	.99 149	$\frac{1}{6}$ KIO ₃	35.67	.55 230
H ₂ S	34.08	.53 250	KMnO ₄	158.03	.19 874
H ₂ SO ₄	98.08	.99 158	2KMnO ₄	316.06	.49 977
$\frac{1}{2}$ H ₂ SO ₄	49.04	.69 055	$\frac{1}{3}$ KMnO ₄	31.606	.49 977
H ₂ SiF ₆	144.32	.15 933			

Formula.	Weight.	Log.	Formula.	Weight.	Log.
KNO ₂	85.11	.92 998	Mo	96.0	.98 227
KNO ₃	101.11	.00 479	MoO ₃	144.0	.15 836
KNaC ₄ H ₄ O ₆ ·4H ₂ O	282.22	.45 059	MoS ₇	160.1	.20 439
K ₂ O	94.20	.97 405			
$\frac{1}{2}$ K ₂ O	47.10	.67 302	N	14.01	.14 644
KOH	56.11	.74 904	N ₂	28.02	.44 747
K ₂ PtCl ₆	486.16	.68 678	NH ₂	16.026	.20 482
$\frac{1}{2}$ K ₂ PtCl ₆	243.08	.38 575	NH ₃	17.034	.23 131
KSCN	97.18	.98 758	NH ₄	18.042	.25 629
K ₂ SO ₄	174.26	.24 120	(NH ₄) ₂	36.084	.55 732
$\frac{1}{2}$ K ₂ SO ₄	87.13	.94 017	NH ₄ Al(SO ₄) ₂ ·12H ₂ O	453.45	.65 653
K ₂ SiF ₆	220.5	.34 341	(NH ₄) ₂ C ₂ O ₄ ·H ₂ O	142.11	.15 262
			N ₂ H ₄ CO	60.06	.77 859
Li	6.94	.84 136	NH ₄ Cl	53.502	.72 837
Li ₂	13.88	.14 239	NH ₄ Fe(SO ₄) ₂ ·12H ₂ O	482.19	.68 322
Li ₂ CO ₃	73.89	.86 859	(NH ₄) ₂ Fe(SO ₄) ₂ ·6H ₂ O	392.14	.59 344
LiCl	42.40	.62 737	NH ₄ NaHPO ₄ ·4H ₂ O	209.15	.32 046
Li ₂ O	29.88	.47 538	(NH ₄) ₂ O	52.084	.71 670
$\frac{1}{2}$ Li ₂ O	14.94	.17 435	NH ₄ OH	35.05	.54 469
Li ₃ PO ₄	115.86	.06 393	NH ₄ NO ₃	80.05	.90 336
Li ₂ SO ₄	109.94	.04 116	(NH ₄) ₂ PtCl ₆	444.04	.64 742
			NH ₄ SCN	76.12	.88 150
Mg	24.32	.38 596	(NH ₄) ₂ SO ₄	132.144	.12 104
Mg ₂ As ₂ O ₇	310.56	.49 214	N ₂ O	44.02	.64 365
MgCO ₃	84.325	.92 596	NO	30.01	.47 727
MgCl ₂ ·6H ₂ O	203.34	.30 822	NO ₂	46.01	.66 285
MgO	40.32	.60 552	NO ₃	62.01	.79 246
Mg ₂ P ₂ O ₇	222.72	.34 776	N ₂ O ₃	76.02	.88 093
MgSO ₄	120.38	.08 055	N ₂ O ₅	108.02	.03 350
MgSO ₄ ·7H ₂ O	246.49	.39 180	$\frac{1}{2}$ N ₂ O ₅	54.01	.73 247
MgSiO ₃	100.62	.00 268			
			Na	23.00	.36 173
Mn	54.93	.73 981	Na ₂	46.00	.66 276
Mn ₂	109.86	.04 084	Na ₃ AlF ₆	210.1	.32 243
MnCO ₃	114.94	.06 047	Na ₂ B ₃ O ₇	202.0	.30 535
MnCl ₂ ·4H ₂ O	197.91	.29 647	Na ₂ B ₄ O ₇ ·10H ₂ O	382.16	.58 225
MnO	70.93	.85 083	NaBr	102.92	.01 250
Mn ₂ O ₃	157.86	.19 828	NaC ₂ H ₃ O ₂	82.03	.91 397
Mn ₃ O ₄	228.79	.35 944	NaC ₂ H ₃ O ₂ ·3H ₂ O	136.08	.13 379
MnO ₂	86.93	.93 917	Na ₂ CO ₃	106.005	.02 533
Mn ₂ O ₇	221.86	.34 608	Na ₂ CO ₃ ·10H ₂ O	286.17	.45 662
Mn ₂ P ₂ O ₇	283.94	.45 323	NaHCO ₃	84.01	.92 433
MnS	86.99	.93 947	NaCl	58.46	.76 686
MnSO ₄	150.99	.17 895	NaClO ₃	106.46	.02 719
MnSO ₄ ·4H ₂ O	223.05	.34 840	NaClO ₄	122.46	.08 799
MnSO ₄ ·7H ₂ O	277.10	.44 264			

Formula.	Weight.	Log.	Formula.	Weight.	Log.
NaF	42.0	.62 325	Pb	207.20	.31 639
Na ₂ HPO ₄ ·12H ₂ O	358.24	.55 418	Pb(C ₂ H ₃ O ₂) ₂ ·3H ₂ O	379.32	.57 900
NaHSO ₃	104.07	.01 733	PbCO ₃	267.21	.42 686
NaHSO ₄	120.07	.07 943	PbCl ₂	278.12	.44 423
NaI	149.92	.17 586	PbCrO ₄	323.20	.50 947
NaNO ₂	69.01	.83 891	Pb(NO ₃) ₂	331.22	.52 012
NaNO ₃	85.01	.92 947	PbO	223.20	.34 869
Na ₂ O	62.00	.79 239	PbO ₂	239.20	.37 876
$\frac{1}{2}$ Na ₂ O	31.00	.49 136	Pb ₃ O ₄	685.60	.83 607
Na ₂ O ₂	78.00	.89 209	PbS	239.26	.37 887
NaOH	40.01	.60 217	PbSO ₄	303.26	.48 181
NaPO ₃	102.04	.00 877			
Na ₄ P ₂ O ₇	266.08	.42 501	Pd	106.7	.02 816
Na ₂ S	78.06	.89 243	PdI ₂	360.54	.55 696
Na ₂ SO ₄	142.06	.15 247			
Na ₂ SO ₄ ·10H ₂ O	322.22	.50 816	Pt	195.2	.29 048
Na ₂ S ₂ O ₃ ·5H ₂ O	248.20	.39 480	PtCl ₄	337.04	.52 768
			PtCl ₆	407.96	.61 062
Ni	58.68	.76 849			
NiCl ₂ ·6H ₂ O	237.70	.37 603	Rb	85.45	.93 171
Ni(NO ₃) ₂ ·6H ₂ O	290.80	.46 359	RbAl(SO ₄) ₂ ·12H ₂ O	520.86	.71 672
NiO	74.68	.87 320	RbCl	120.91	.08 246
NiS	90.74	.95 780	Rb ₂ O	186.90	.27 161
NiSO ₄	154.74	.18 960	Rb ₂ PtCl ₆	578.86	.76 257
NiSO ₄ ·6H ₂ O	262.84	.41 969	Rb ₂ SO ₄	266.96	.42 645
NiSO ₄ ·7H ₂ O	280.85	.44 848			
Ni(NH ₄) ₂ (SO ₄) ₂ ·6H ₂ O	394.98	.59 658	S	32.06	.50 596
			S ₂	64.12	.80 699
O	16.00	.20 412	SCN	58.075	.76 399
O ₂	32.00	.50 515	SO ₂	64.06	.80 659
O ₃	48.00	.68 124	SO ₃	80.06	.90 342
O ₄	64.00	.80 618	SO ₄	96.06	.98 254
O ₅	80.00	.90 309			
O ₆	96.00	.98 227	Sb	120.2	.07 990
OH	17.008	.23 065	2Sb	240.4	.38 093
			SbCl ₃	226.58	.35 522
P	31.04	.49 192	SbCl ₅	297.50	.47 349
P ₂	62.08	.79 295	Sb ₂ O ₃	288.4	.46 000
PCl ₃	137.42	.13 805	$\frac{1}{2}$ Sb ₂ O ₃	144.2	.15 897
PCl ₅	208.34	.31 877	Sb ₂ O ₅	320.4	.50 569
P ₂ O ₅	142.08	.15 253	$\frac{1}{2}$ Sb ₂ O ₅	160.2	.20 466
$\frac{1}{2}$ P ₂ O ₅	71.04	.85 150	Sb ₂ O ₄	304.4	.48 344
PO ₄	95.04	.97 791	SbOCl	171.7	.23 477
2PO ₄	190.08	.27 894	SbOKC ₄ H ₄ O ₆ · $\frac{1}{2}$ H ₂ O	332.36	.52 161
P ₂ O ₃	110.08	.04 171	Sb ₂ S ₃	336.6	.52 711
P ₂ O ₇	174.08	.24 075	Sb ₂ S ₅	400.7	.60 282

Formula.	Weight.	Log.	Formula.	Weight.	Log.
Se	79.2	.89 873	Th	232.4	.36 624
SeO ₂	111.2	.04 610	ThO ₂	264.4	.42 226
SeO ₃	127.2	.10 449	Ti	48.1	.68 215
Si	28.3	.45 179	TiO ₂	80.1	.90 363
Si ₂	56.6	.75 282	Tl	204.0	.30 963
SiF ₄	104.3	.01 828	TlCl	239.46	.37 923
SiF ₆	142.3	.15 320	TlH	330.92	.51 973
SiO ₂	60.3	.78 032	TlNO ₃	266.01	.42 490
SiO ₃	76.3	.88 252	Tl ₂ PtCl ₆	815.96	.91 167
SiO ₄	92.3	.96 520	U	238.2	.37 694
Si ₃ O ₃	212.9	.32 818	UO ₂	270.2	.43 169
Sn	118.7	.07 445	U ₃ O ₈	842.6	.92 562
SnCl ₂	189.62	.27 789	UO ₂ (C ₂ H ₃ O ₂) ₂ ·2H ₂ O	424.30	.62 767
SnCl ₂ ·2H ₂ O	225.65	.35 344	UO ₂ (NO ₃) ₂ ·6H ₂ O	502.32	.70 098
SnCl ₄	260.54	.41 587	U ₂ P ₂ O ₁₁	714.48	.85 399
SnO	134.7	.12 937	V	51.0	.70 757
SnO ₂	150.7	.17 811	V ₂ O ₅	182.0	.26 007
SnS	150.76	.17 828	W	184.0	.26 482
SnS ₂	182.82	.26 203	WO ₃	232.0	.36 549
Sr	87.63	.94 265	Zn	65.37	.81 538
SrCO ₃	147.64	.16 920	ZnCO ₃	125.38	.09 823
SrCl ₂ ·6H ₂ O	266.65	.42 594	ZnCl ₂	136.29	.13 446
Sr(NO ₃) ₂	211.65	.32 562	ZnO	81.37	.91 046
SrO	103.63	.01 549	ZnS	97.43	.98 869
Sr(OH) ₂ ·8H ₂ O	265.77	.42 450	ZnSO ₄	161.43	.20 798
SrSO ₄	183.69	.26 409	ZnSO ₄ ·7H ₂ O	287.54	.45 870
Te	127.5	.10 551	Zr	90.6	.95 713
TeO ₂	159.5	.20 276	ZrO ₂	122.6	.08 849
TeO ₃	175.5	.24 428			
TeO ₃ ·3H ₂ O	229.55	.36 088			
H ₂ O	18.016	.25 565	13H ₂ O	234.21	.36 961
2H ₂ O	36.032	.55 668	14H ₂ O	252.22	.40 178
3H ₂ O	54.048	.73 278	15H ₂ O	270.24	.43 175
4H ₂ O	72.064	.85 771	16H ₂ O	288.26	.45 978
5H ₂ O	90.08	.95 463	17H ₂ O	306.27	.48 611
6H ₂ O	108.10	.03 383	18H ₂ O	324.29	.51 094
7H ₂ O	126.11	.10 075	19H ₂ O	342.30	.53 441
8H ₂ O	144.13	.15 875	20H ₂ O	360.32	.55 668
9H ₂ O	162.14	.20 989	21H ₂ O	378.34	.57 788
10H ₂ O	180.16	.25 565	22H ₂ O	396.35	.59 808
11H ₂ O	198.18	.29 706	23H ₂ O	414.37	.61 739
12H ₂ O	216.19	.33 484	24H ₂ O	432.38	.63 587

TABLE IV.
INDIRECT ANALYSES.

Mixture. <i>a.</i>	Determined. <i>b.</i>	Formula.
AgBr } AgI }	Loss by fusing in chlorine	$\left\{ \begin{array}{l} \text{AgBr} = 2.5496 a - 6.5454 b \\ \quad (\log .40\ 647) \quad (\log .81\ 594) \\ \text{AgI} = - 1.5496 a + 6.5454 b \\ \quad (\log .19\ 022) \quad (\log .81\ 594) \end{array} \right.$
AgBr } AgI }	Loss by fusing in chlorine.	$\left\{ \begin{array}{l} \text{Br} = 1.0850 a - 2.7855 b \\ \quad (\log .03\ 543) \quad (\log .44\ 490) \\ \text{I} = - .83758 a + 3.5380 b \\ \quad (\log .92\ 303) \quad (\log .54\ 876) \end{array} \right.$
NaCl } KCl }	Cl	$\left\{ \begin{array}{l} \text{NaCl} = - 3.6310 a + 7.6348 b \\ \quad (\log .56\ 003) \quad (\log .88\ 280) \\ \text{KCl} = 4.6310 a - 7.6348 b \\ \quad (\log .66\ 567) \quad (\log .88\ 280) \end{array} \right.$
Na ₂ SO ₄ } K ₂ SO ₄ }	BaSO ₄	$\left\{ \begin{array}{l} \text{Na}_2\text{SO}_4 = - 4.4108 a + 3.2928 b \\ \quad (\log .64\ 452) \quad (\log .51\ 756) \\ \text{K}_2\text{SO}_4 = 5.4108 a - 3.2928 b \\ \quad (\log .73\ 326) \quad (\log .51\ 756) \end{array} \right.$
Na ₂ SO ₄ } Li ₂ SO ₄ }	BaSO ₄	$\left\{ \begin{array}{l} \text{Na}_2\text{SO}_4 = 4.4228 a - 2.0830 b \\ \quad (\log .64\ 570) \quad (\log .31\ 869) \\ \text{Li}_2\text{SO}_4 = - 3.4228 a + 2.0830 b \\ \quad (\log .53\ 438) \quad (\log .31\ 869) \end{array} \right.$
Rb ₂ PtCl ₆ } Cs ₂ PtCl ₆ }	Rb ₂ SO ₄ } Cs ₂ SO ₄ }	$\left\{ \begin{array}{l} \text{Rb}_2\text{SO}_4 = 3.2682 a - 6.0866 b \\ \quad (\log .51\ 431) \quad (\log .78\ 437) \\ \text{Cs}_2\text{SO}_4 = - 3.2682 a + 7.0866 b \\ \quad (\log .51\ 431) \quad (\log .85\ 044) \end{array} \right.$

Note. — This table is given to show a few convenient formulas for calculating the results of indirect analyses in cases where two transformations occur together. The formulas themselves may be readily derived from the proper factors by the use of algebra. For instance, for the third pair of formulas given above we have:

$$\text{NaCl} + \text{KCl} = a, \text{ and } .60656 \text{ NaCl} + .47559 \text{ KCl} = b,$$

and the solution of these simultaneous equations gives the formulas.

Of the formulas given in the table, the first two pairs represent a process that has been frequently employed, and is capable of giving good results. The student should be warned, however, against the use of most of the methods of complex indirect determination, except for the purpose of obtaining approximate results, because the errors in the determinations are largely increased in the final results. For example, the formulas indicate that an error of one part in 100 in the determination of chlorine in a mixture of NaCl and KCl would produce errors of 7.6 parts in 100 in the calculated amounts of the salts.

TABLE V.

REDUCTION OF GAS-VOLUMES TO 0° AND 760 MM.

Vol. at 0° and 760 mm = v . F . ($h-w$). v = Volume of gas (cc); t = Temperature of gas (C.°); w = Tension of aqueous vapor (mm). F = Factor from table = $\frac{1}{760(1+.00367t)}$; h = Barometer-height, corrected, (mm);

t° .	Log F .*	w .	t° .	Log F .*	w .
0	.11 919	4.6	15	.09 592	12.7
0.5	.11 839	4.8	15.5	.09 517	13.1
1	.11 760	4.9	16	.09 441	13.5
1.5	.11 681	5.1	16.5	.09 366	13.9
2	.11 602	5.3	17	.09 291	14.4
2.5	.11 523	5.5	17.5	.09 216	14.9
3	.11 444	5.7	18	.09 141	15.3
3.5	.11 365	5.9	18.5	.09 067	15.8
4	.11 286	6.1	19	.08 992	16.3
4.5	.11 208	6.3	19.5	.08 918	16.8
5	.11 129	6.5	20	.08 843	17.4
5.5	.11 051	6.7	20.5	.08 769	17.9
6	.10 973	7.0	21	.08 695	18.5
6.5	.10 895	7.2	21.5	.08 621	19.0
7	.10 817	7.5	22	.08 547	19.6
7.5	.10 740	7.7	22.5	.08 474	20.2
8	.10 662	8.0	23	.08 400	20.9
8.5	.10 585	8.3	23.5	.08 327	21.5
9	.10 508	8.5	24	.08 253	22.2
9.5	.10 430	8.8	24.5	.08 180	22.8
10	.10 354	9.1	25	.08 107	23.5
10.5	.10 277	9.4	25.5	.08 034	24.2
11	.10 201	9.8	26	.07 961	25.0
11.5	.10 124	10.1	26.5	.07 888	25.7
12	.10 048	10.4	27	.07 816	26.5
12.5	.09 972	10.8	27.5	.07 743	27.3
13	.09 896	11.1	28	.07 671	28.1
13.5	.09 820	11.5	28.5	.07 599	28.9
14	.09 744	11.9	29	.07 527	29.7
14.5	.09 668	12.3	29.5	.07 455	30.6
			30	.07 383	31.5

* The characteristic of all the logarithms is -3.

TABLE VI.

CALCULATION OF PERCENTAGE OF NITROGEN FROM THE GAS-VOLUME.

$$\%N = \frac{v.F.(h-w)}{S}.$$

(100 g. H₂O + 30 g. KOH = 23.1% KOH) v = Volume of nitrogen (cc).

$$F = \text{Factor (table)} = \frac{.0012510 \times 100}{760(1 + .00367t)}.$$

 h = Height of barometer, corrected (mm). w = Tension of aqueous vapor (mm). S = Weight of substance (g). t = Temperature of gas (C.^o).

23.1% KOH				23.1% KOH.			
t° .	Log. F^{*}	v .	w .	t° .	Log F^{*}	v .	w .
0	.21 645	3.7	4.6	15.5	.19 243	10.5	13.1
0.5	.21 565	3.8	4.8	16	.19 167	10.8	13.5
1	.21 486	3.9	4.9	16.5	.19 092	11.2	13.9
1.5	.21 407	4.1	5.1	17	.19 017	11.5	14.4
2	.21 328	4.2	5.3	17.5	.18 942	11.9	14.9
2.5	.21 249	4.4	5.5	18	.18 867	12.3	15.3
3	.21 170	4.5	5.7	18.5	.18 793	12.7	15.8
3.5	.21 091	4.7	5.9	19	.18 718	13.1	16.3
4	.21 012	4.9	6.1	19.5	.18 644	13.5	16.8
4.5	.20 934	5.0	6.3	20	.18 569	13.9	17.4
5	.20 855	5.2	6.5	20.5	.18 495	14.4	17.9
5.5	.20 777	5.4	6.7	21	.18 421	14.8	18.5
6	.20 699	5.6	7.0	21.5	.18 347	15.3	19.0
6.5	.20 621	5.8	7.2	22	.18 273	15.8	19.6
7	.20 543	6.0	7.5	22.5	.18 200	16.3	20.2
7.5	.20 466	6.2	7.7	23	.18 126	16.8	20.9
8	.20 388	6.4	8.0	23.5	.18 053	17.3	21.5
8.5	.20 311	6.6	8.3	24	.17 979	17.8	22.2
9	.20 234	6.8	8.5	24.5	.17 906	18.4	22.8
9.5	.20 156	7.0	8.8	25	.17 833	18.9	23.5
10	.20 080	7.3	9.1	25.5	.17 760	19.5	24.2
10.5	.20 003	7.6	9.4	26	.17 687	20.1	25.0
11	.19 927	7.8	9.8	26.5	.17 614	20.7	25.7
11.5	.19 850	8.1	10.1	27	.17 542	21.3	26.5
12	.19 774	8.3	10.4	27.5	.17 469	21.9	27.3
12.5	.19 698	8.6	10.8	28	.17 397	22.6	28.1
13	.19 622	8.9	11.1	28.5	.17 325	23.3	28.9
13.5	.19 546	9.2	11.5	29	.17 253	24.0	29.7
14	.19 470	9.5	11.9	29.5	.17 181	24.7	30.6
14.5	.19 394	9.8	12.3	30	.17 109	25.4	31.5
15	.19 318	10.1	12.7				

Note. — The table is based on Lord Rayleigh's weight of nitrogen, at latitude 41° and sea-level, 0.0012510 g.

* The characteristic of all the logarithms is -4 .

TABLE VII.

BAROMETER CORRECTIONS.

FOR TEMPERATURE.

Glass Scale (Bunsen). mm. to be deducted.						Brass Scale (Delcros). mm. to be deducted.					
t°.	Reading.					t°.	Reading.				
	700	720	740	760	780		700	720	740	760	780
1	0.120	0.123	0.127	0.130	0.133	1	0.113	0.116	0.119	0.123	0.126
2	0.2	0.2	0.3	0.3	0.3	2	0.2	0.2	0.2	0.3	0.3
3	0.4	0.4	0.4	0.4	0.4	3	0.3	0.4	0.4	0.4	0.4
4	0.5	0.5	0.5	0.5	0.5	4	0.5	0.5	0.5	0.5	0.5
5	0.6	0.6	0.6	0.7	0.7	5	0.6	0.6	0.6	0.6	0.6
6	0.7	0.7	0.8	0.8	0.8	6	0.7	0.7	0.7	0.7	0.8
7	0.8	0.9	0.9	0.9	0.9	7	0.8	0.8	0.8	0.9	0.9
8	1.0	1.0	1.0	1.0	1.1	8	0.9	0.9	1.0	1.0	1.0
9	1.1	1.1	1.1	1.2	1.2	9	1.0	1.0	1.1	1.1	1.1
10	1.2	1.2	1.3	1.3	1.3	10	1.1	1.2	1.2	1.2	1.3
11	1.3	1.4	1.4	1.4	1.5	11	1.2	1.3	1.3	1.4	1.4
12	1.4	1.5	1.5	1.6	1.6	12	1.4	1.4	1.4	1.5	1.5
13	1.6	1.6	1.7	1.7	1.7	13	1.5	1.5	1.6	1.6	1.6
14	1.7	1.7	1.8	1.8	1.9	14	1.6	1.7	1.7	1.7	1.8
15	1.8	1.8	1.9	2.0	2.0	15	1.7	1.8	1.8	1.8	1.9
16	1.9	2.0	2.0	2.1	2.1	16	1.8	1.9	1.9	2.0	2.0
17	2.0	2.1	2.2	2.2	2.3	17	1.9	2.0	2.0	2.1	2.1
18	2.2	2.2	2.3	2.3	2.4	18	2.0	2.1	2.2	2.2	2.3
19	2.3	2.3	2.4	2.5	2.5	19	2.1	2.2	2.3	2.3	2.4
20	2.4	2.5	2.5	2.6	2.7	20	2.3	2.3	2.4	2.5	2.5
21	2.5	2.6	2.7	2.7	2.8	21	2.4	2.5	2.5	2.6	2.7
22	2.6	2.7	2.8	2.9	2.9	22	2.5	2.6	2.6	2.7	2.8
23	2.8	2.8	2.9	3.0	3.1	23	2.6	2.7	2.8	2.8	2.9
24	2.9	3.0	3.0	3.1	3.2	24	2.7	2.8	2.9	2.9	3.0
25	3.0	3.1	3.2	3.3	3.3	25	2.8	3.0	3.1	3.0	3.2
26	3.1	3.2	3.3	3.4	3.5	26	2.9	3.1	3.1	3.2	3.3
27	3.2	3.3	3.4	3.5	3.6	27	3.1	3.2	3.2	3.3	3.4
28	3.4	3.4	3.5	3.6	3.7	28	3.2	3.3	3.3	3.4	3.5
29	3.5	3.6	3.7	3.8	3.9	29	3.3	3.4	3.5	3.6	3.7
30	3.6	3.7	3.8	3.9	4.0	30	3.4	3.5	3.6	3.7	3.8

Notes on Densities of Gases and Vapors. — The molecular weight in grams of any gas or vapor has a volume of 22.4 liters at 0° and 760 mm. Hence:

$$\text{Mol. wt.} = 22.4 \times \text{wt. of 1 liter in grams.}$$

and

$$\text{Wt. of 1 liter in grams.} = \text{mol. wt.} \div 22.4.$$

In most cases the values derived from these formulas do not correspond precisely with the observed values, but they suffice for most practical purposes. For instance, the volume of 32 g. of oxygen is 22.390 instead of 22.4 l., and in other cases there is still greater variation.

It happens that the relation between grams and liters is practically the same as that between ounces, avoirdupois and cubic feet, hence:

$$\text{Wt. of 1 cu. ft. in ounces, av.} = \text{mol. wt.} \div 22.4.$$

The density of air corresponds to a mean molecular weight of 29, or more precisely 28.95 when compared with O₂ as 32. Hence the molecular weight of a gas or vapor divided by 29 gives its density compared with air at the same temperature and pressure. 1 l. air at 0° and 760 mm. = 1.2928 g.

TABLE VIII.

MULTIPLES FOR ORGANIC COMPOUNDS.

Number.	Log.	Number.	Log.	Number.	Log.			
H	1.008	.00 346	C	12.005	.07 936	N	14.01	.14 644
H ₂	2.016	.30 449	C ₂	24.01	.38 039	N ₂	28.02	.44 747
H ₃	3.024	.48 058	C ₃	36.02	.55 654	N ₃	42.03	.62 356
H ₄	4.032	.60 552	C ₄	48.02	.68 142	N ₄	56.04	.74 850
H ₅	5.040	.70 243	C ₅	60.03	.77 837	N ₅	70.05	.84 541
H ₆	6.048	.78 161	C ₆	72.03	.85 751	N ₆	84.06	.92 459
H ₇	7.056	.84 856	C ₇	84.04	.92 449	N ₇	98.07	.99 154
H ₈	8.064	.90 655	C ₈	96.04	.98 245	N ₈	112.08	.04 953
H ₉	9.072	.95 770	C ₉	108.05	.03 362	S	32.06	.50 596
H ₁₀	10.08	.00 346	C ₁₀	120.05	.07 936	S ₂	64.12	.80 699
H ₁₁	11.09	.04 493	C ₁₁	132.06	.12 077	S ₃	96.18	.98 308
H ₁₂	12.10	.08 279	C ₁₂	144.06	.15 854	S ₄	128.24	.10 802
H ₁₃	13.10	.11 727	C ₁₃	156.07	.19 332	S ₅	160.30	.20 493
H ₁₄	14.11	.14 953	C ₁₄	168.07	.22 549	S ₆	192.36	.28 412
H ₁₅	15.12	.17 955	C ₁₅	180.08	.25 546	Cl	35.46	.54 974
H ₁₆	16.13	.20 763	C ₁₆	192.08	.28 348	Cl ₂	70.92	.85 077
H ₁₇	17.14	.23 401	C ₁₇	204.09	.30 982	Cl ₃	106.38	.02 686
H ₁₈	18.14	.25 864	C ₁₈	216.09	.33 463	Cl ₄	141.84	.15 180
H ₁₉	19.15	.28 217	C ₁₉	228.10	.35 813	Cl ₅	177.30	.24 871
H ₂₀	20.16	.30 449	C ₂₀	240.10	.38 039	Cl ₆	212.76	.32 789
H ₂₁	21.17	.32 572	C ₂₁	252.11	.40 159	Br	79.92	.90 266
H ₂₂	22.18	.34 596	C ₂₂	264.11	.42 179	Br ₂	159.84	.20 369
H ₂₃	23.18	.36 511	C ₂₃	276.12	.44 110	Br ₃	239.76	.37 978
H ₂₄	24.19	.38 364	C ₂₄	288.12	.45 957	Br ₄	319.68	.50 472
H ₂₅	25.20	.40 140	C ₂₅	300.13	.47 731	I	126.92	.10 353
H ₂₆	26.21	.41 847	C ₂₆	312.13	.49 433	I ₂	253.84	.40 456
H ₂₇	27.22	.43 489	C ₂₇	324.14	.51 073	I ₃	380.76	.58 065
H ₂₈	28.22	.45 056	C ₂₈	336.14	.52 652	I ₄	507.68	.70 559
H ₂₉	29.23	.46 583	C ₂₉	348.15	.54 177	O ₁₁	176	.24 551
H ₃₀	30.24	.48 058	C ₃₀	360.15	.55 648	O ₁₂	192	.28 330
H ₃₁	31.25	.49 485	O	16	.20 412	O ₁₃	208	.31 806
H ₃₂	32.26	.50 866	O ₂	32	.50 515	O ₁₄	224	.35 025
H ₃₃	33.26	.52 192	O ₃	48	.68 124	O ₁₅	240	.38 021
H ₃₄	34.27	.53 491	O ₄	64	.80 618	O ₁₆	256	.40 824
H ₃₅	35.28	.54 753	O ₅	80	.90 309	O ₁₇	272	.43 457
H ₃₆	36.29	.55 979	O ₆	96	.98 227	O ₁₈	288	.45 939
H ₃₇	37.30	.57 171	O ₇	112	.04 922	O ₁₉	304	.48 287
H ₃₈	38.30	.58 320	O ₈	128	.10 721	O ₂₀	320	.50 515
H ₃₉	39.31	.59 450	O ₉	144	.15 836	O ₂₁	336	.52 634
H ₄₀	40.32	.60 552	O ₁₀	160	.20 412	O ₂₂	352	.54 654

TABLE IX.

CONSTANTS FOR MOLECULAR-WEIGHT DETERMINATIONS.

(The constants are taken from Ostwald-Luther "Physiko-Chemische Messungen.")

The formula is $M = K \frac{s}{\Delta L}$, where M is the molecular weight of the dissolved substance, s its weight in grams, L the weight of the solvent in grams, Δ the observed change in temperature, and K is the constant, which depends upon the nature of the solvent.

BY DEPRESSION OF FREEZING-POINT.

Solvent.	Melts at.	---K.---	
		N.	Log.
Water	0°	1850	.2672
Benzole	5.5	5000	.6990
Naphthaline	80	7000	.8451
Phenanthrene	96	12000	.0792
Phenol	39	7500	.8751
Glacial acetic acid	17.7	3900	.5911
Nitrobenzole	5.3	7000	.8451
P. toluidine	42.5	5100	.7076

BY ELEVATION OF BOILING-POINT.

Solvent.	Boils at.	---K.---	
		N.	Log.
Ethyl ether	35°	2160	.3345
Benzole	80	2610	.4166
Chloroform	61	3590	.5551
Carbon bisulphide	46	2350	.3711
Glacial acetic acid	118	2530	.4031
Ethyl alcohol	78	1170	.0682
Ethyl acetate	75	2680	.4281
Acetone	56	1720	.2355
Water	100	510	.7076
Ethylene bromide	132	6450	.8096
Aniline	182	3220	.5079
Phenol	132	3040	.4829

TABLE X.

WEIGHTS AND MEASURES.

LENGTH.

Given.	Sought.	Multiply by Factor.	
		N.	Log.
Inches	Centimeters	2.540	.40 483
Centimeters	Inches	.39370	.59 517
Feet	Meters	.30480	.48 402
Meters	Feet	3.2808	.51 598
Miles	Kilometers	1.6093	.20 665
Kilometers	Miles	.62137	.79 335

AREA.

Sq. Inches	Sq. Centimeters	6.4516	.80 967
Sq. Centimeters	Sq. Inches	.1550	.19 033
Sq. Feet	Sq. Meters	.09290	.96 803
Sq. Meters	Sq. Feet	10.764	.03 197

VOLUME.

Cu. Inches	Cu. Centimeters	16.387	.21 450
Cu. Centimeters	Cu. Inches	.06102	.78 550
Cu. Feet	Cu. Meters	.02832	.45 205
Cu. Meters	Cu. Feet	35.314	.54 795

CAPACITY.

U. S. Fluid Ounces	Cu. Centimeters	29.574	.47 091
Cu. Centimeters	U. S. Fluid Ounces	.03381	.52 909
U. S. Quarts	Liters	.94635	.97 605
Liters	U. S. Quarts	1.0567	.02 395
U. S. Gallons	Liters	3.7854	.57 812
Liters	U. S. Gallons	.26417	.42 188

WEIGHT.

Grains	Grams	.06480	.81 157
Grams	Grains	15.432	.18 843
Ounces, troy	Grams	31.103	.49 281
Grams	Ounces, troy	.03215	.50 719
Ounces, av.	Grams	28.350	.45 255
Grams	Ounces, av.	.03527	.54 745
Pounds, av.	Grams	453.59	.65 667
Kilograms	Pounds, av.	2.2046	.34 333

NOTES ON THE USE OF LOGARITHMS.

In these tables the "characteristics" of the logarithms, or the figures before their decimal points which fix the decimal points of the numbers, have been omitted, because in ordinary chemical calculations it is usually easier to find the positions of the decimal points by simple inspection of the numbers employed than by the use of characteristics.

For example, suppose we have;

$$.4693 \text{ g. AgCl (log .67145)}$$

to be multiplied by the factor which gives the amount of chlorine in it,

$$.24738 \text{ (log .39336).}$$

The addition of the logs gives the log .06481, corresponding to the numerical figures 11610.

Now by inspection, since .24738 is nearly $\frac{1}{4}$, or since .4693 is nearly $\frac{1}{2}$, it is evident that the result must be not far from $\frac{1}{4}$ of .4693 or $\frac{1}{2}$ of .24738, so that the decimal point must be placed to correspond; that is, .11610.

Now if we divide the amount of chlorine by the weight of substance taken for analysis, say .2603 g. (log .41547) we have $.06481 - .41547 = .64934$, corresponding to the number .44601, the decimal point of which is found by inspection, since the result must be about 4 times .11610. Multiplying this by 100 we find 44.60% of chlorine. The fifth figure in this result is an uncertain one because it is derived from the datum .2603; hence it is best not to report it. In this case the trouble of interpolating for a fifth figure might have been avoided by taking four figures corresponding to the nearest logarithm.

By the use of a co-logarithm (i.e., $1 - \log$) of the division the preceding calculation may be made by a single addition:

AgCl,	.4693	log	.67145
Factor,	.24738	log	.39336
Substance, .2603		$1 - \log$	.58453

$$.64934 \rightarrow 44.60\%$$

An inspection of the numbers employed above shows the position of the decimal point. The result could not possibly be 4.460%.

The student who is not skilful in the use of logarithms should practice multiplications and divisions with numbers giving known results until he acquires proficiency.

The easily remembered logarithm of 2, which is .30103, is often of considerable assistance in calculations. For instance, the logarithm of the atomic weight of Mg, 24.32, is .38596; hence the log of 2 Mg is .68699 and that of $\frac{1}{2}$ Mg is .08493.

LOGARITHMS OF NUMBERS

FIVE-PLACE TABLE

WITH

DOUBLE THUMB-INDEX

N.	0	1	2	3	4	5	6	7	8	9	P. P.
100	00 000	043	087	130	173	217	260	303	346	389	1 44 43 42 2 4 4 4 3 9 9 8 4 13 13 13 5 18 17 17 6 22 22 21 7 26 26 25 8 31 30 29 9 35 34 34 40 39 38
101	432	475	518	561	604	647	689	732	775	817	
102	860	903	945	988	*030	*072	*115	*157	*199	*242	
103	01 284	326	368	410	452	494	536	578	620	662	
104	703	745	787	828	870	912	953	995	*036	*078	
105	02 119	160	202	243	284	325	366	407	449	490	1 41 40 39 2 4 4 4 3 8 8 8 4 12 12 12 5 16 16 16 6 21 20 20 7 25 24 23 8 29 28 27 9 33 32 31 37 36 35
106	531	572	612	653	694	735	776	816	857	898	
107	938	979	*019	*060	*100	*141	*181	*222	*262	*302	
108	03 342	383	423	463	503	543	583	623	663	703	
109	743	782	822	862	902	941	981	*021	*060	*100	
110	04 139	179	218	258	297	336	376	415	454	493	1 41 40 39 2 4 4 4 3 8 8 8 4 12 12 12 5 16 16 16 6 21 20 20 7 25 24 23 8 29 28 27 9 33 32 31 37 36 35
111	532	571	610	650	689	727	766	805	844	883	
112	922	961	999	*038	*077	*115	*154	*192	*231	*269	
113	05 308	346	385	423	461	500	538	576	614	652	
114	690	729	767	805	843	881	918	956	994	*032	
115	06 070	108	145	183	221	258	296	333	371	408	1 38 37 36 2 4 4 4 3 8 7 7 4 11 11 11 5 15 15 14 6 19 19 18 7 23 22 22 8 27 26 25 9 30 30 29 34 33 32
116	446	483	521	558	595	633	670	707	744	781	
117	819	856	893	930	967	*004	*041	*078	*115	*151	
118	07 188	225	262	298	335	372	408	445	482	518	
119	555	591	628	664	700	737	773	809	846	882	
120	918	954	990	*027	*063	*099	*135	*171	*207	*243	1 38 37 36 2 4 4 4 3 8 7 7 4 11 11 11 5 15 15 14 6 19 19 18 7 23 22 22 8 27 26 25 9 30 30 29 34 33 32
121	08 279	314	350	386	422	458	493	529	565	600	
122	636	672	707	743	778	814	849	884	920	955	
123	991	*026	*061	*096	*132	*167	*202	*237	*272	*307	
124	09 342	377	412	447	482	517	552	587	621	656	
125	691	726	760	795	830	864	899	934	968	*003	1 35 34 33 2 4 3 3 3 7 7 7 4 11 10 10 5 14 14 13 6 18 17 17 7 21 20 20 8 25 24 23 9 28 27 26 32 31 30
126	10 037	072	106	140	175	209	243	278	312	346	
127	380	415	449	483	517	551	585	619	653	687	
128	721	755	789	823	857	890	924	958	992	*025	
129	11 059	093	126	160	193	227	261	294	327	361	
130	394	428	461	494	528	561	594	628	661	694	1 35 34 33 2 4 3 3 3 7 7 7 4 11 10 10 5 14 14 13 6 18 17 17 7 21 20 20 8 25 24 23 9 28 27 26 32 31 30
131	727	760	793	826	860	893	926	959	992	*024	
132	12 057	090	123	156	189	222	254	287	320	352	
133	385	418	450	483	516	548	581	613	646	678	
134	710	743	775	808	840	872	905	937	969	*001	
135	13 033	066	098	130	162	194	226	258	290	322	1 32 31 30 2 3 3 3 3 6 6 6 4 10 9 9 5 13 12 12 6 16 16 15 7 19 19 18 8 22 22 21 9 26 25 24 29 28 27
136	354	386	418	450	481	513	545	577	609	640	
137	672	704	735	767	799	830	862	893	925	956	
138	988	*019	*051	*082	*114	*145	*176	*208	*239	*270	
139	14 301	333	364	395	426	457	489	520	551	582	
140	613	644	675	706	737	768	799	829	860	891	1 32 31 30 2 3 3 3 3 6 6 6 4 10 9 9 5 13 12 12 6 16 16 15 7 19 19 18 8 22 22 21 9 26 25 24 29 28 27
141	922	953	983	*014	*045	*076	*106	*137	*168	*198	
142	15 229	259	290	320	351	381	412	442	473	503	
143	534	564	594	625	655	685	715	746	776	806	
144	836	866	897	927	957	987	*017	*047	*077	*107	
145	16 137	167	197	227	256	286	316	346	376	406	1 32 31 30 2 3 3 3 3 6 6 6 4 10 9 9 5 13 12 12 6 16 16 15 7 19 19 18 8 22 22 21 9 26 25 24 29 28 27
146	435	465	495	524	554	584	613	643	673	702	
147	732	761	791	820	850	879	909	938	967	997	
148	17 026	056	085	114	143	173	202	231	260	289	
149	319	348	377	406	435	464	493	522	551	580	
N.	0	1	2	3	4	5	6	7	8	9	P. P.

N.	0	1	2	3	4	5	6	7	8	9	P. P.			
150	17	609	638	667	696	725	754	782	811	840	869	1	29	28
151		898	926	955	984	*013	*041	*070	*099	*127	*156		3	3
152	18	184	213	241	270	298	327	355	384	412	441		6	6
153		469	498	526	554	583	611	639	667	696	724		9	8
154		752	780	808	837	865	893	921	949	977	*005		12	11
155	19	033	061	089	117	145	173	201	229	257	285	2	15	14
156		312	340	368	396	424	451	479	507	535	562		17	17
157		590	618	645	673	700	728	756	783	811	838		20	20
158		866	893	921	948	976	*003	*030	*058	*085	*112		23	22
159	20	140	167	194	222	249	276	303	330	358	385		26	25
160		412	439	466	493	520	548	575	602	629	656	3	27	26
161		683	710	737	763	790	817	844	871	898	925		3	3
162		952	978	*005	*032	*059	*085	*112	*139	*165	*192		5	5
163	21	219	245	272	299	325	352	378	405	431	458		8	8
164		484	511	537	564	590	617	643	669	696	722		11	10
165		748	775	801	827	854	880	906	932	958	985	4	14	13
166	22	011	037	063	089	115	141	167	194	220	246		16	16
167		272	298	324	350	376	401	427	453	479	505		19	18
168		531	557	583	608	634	660	686	712	737	763		22	21
169		789	814	840	866	891	917	943	968	994	*019		24	23
170	23	045	070	096	121	147	172	198	223	249	274	5	25	
171		300	325	350	376	401	426	452	477	502	528		3	3
172		553	578	603	629	654	679	704	729	754	779		5	5
173		805	830	855	880	905	930	955	980	*005	*030		8	
174	24	055	080	105	130	155	180	204	229	254	279		10	10
175		304	329	353	378	403	428	452	477	502	527	6	13	
176		551	576	601	625	650	674	699	724	748	773		15	
177		797	822	846	871	895	920	944	969	993	*018		18	
178	25	042	066	091	115	139	164	188	212	237	261		20	
179		285	310	334	358	382	406	431	455	479	503		23	
180		527	551	575	600	624	648	672	696	720	744	7	24	23
181		768	792	816	840	864	888	912	935	959	983		2	2
182	26	007	031	055	079	102	126	150	174	198	221		5	5
183		245	269	293	316	340	364	387	411	435	458		7	7
184		482	505	529	553	576	600	623	647	670	694		10	9
185		717	741	764	788	811	834	858	881	905	928	8	12	12
186		951	975	998	*021	*045	*068	*091	*114	*138	*161		14	14
187	27	184	207	231	254	277	300	323	346	370	393		17	16
188		416	439	462	485	508	531	554	577	600	623		19	18
189		646	669	692	715	738	761	784	807	830	852		22	21
190		875	898	921	944	967	989	*012	*035	*058	*081	9	22	21
191	28	103	126	149	171	194	217	240	262	285	307		2	2
192		330	353	375	398	421	443	466	488	511	533		4	4
193		556	578	601	623	646	668	691	713	735	758		7	6
194		780	803	825	847	870	892	914	937	959	981		9	8
195	29	003	026	048	070	092	115	137	159	181	203	1	11	11
196		226	248	270	292	314	336	358	380	403	425		13	13
197		447	469	491	513	535	557	579	601	623	645		15	15
198		667	688	710	732	754	776	798	820	842	863		18	17
199		885	907	929	951	973	994	*016	*038	*060	*081		20	19
N.	0	1	2	3	4	5	6	7	8	9	P. P.			

N.	0	1	2	3	4	5	6	7	8	9	P. P.
200	30 103	125	146	168	190	211	233	255	276	298	22 21 2 2 4 4 7 6 9 8
201	320	341	363	384	406	428	449	471	492	514	
202	535	557	578	600	621	643	664	685	707	728	
203	750	771	792	814	835	856	878	899	920	942	
204	963	984	*006	*027	*048	*069	*091	*112	*133	*154	
205	31 175	197	218	239	260	281	302	323	345	366	11 11 13 13 15 15 18 17 20 19
206	387	408	429	450	471	492	513	534	555	576	
207	597	618	639	660	681	702	723	744	765	785	
208	806	827	848	869	890	911	931	952	973	994	
209	32 015	035	056	077	098	118	139	160	181	201	
210	222	243	263	284	305	325	346	366	387	408	20 2 2 4 6 8 8 10 10 12 12 14 14 16 16 18 18
211	428	449	469	490	510	531	552	572	593	613	
212	634	654	675	695	715	736	756	777	797	818	
213	838	858	879	899	919	940	960	980	*001	*021	
214	33 041	062	082	102	122	143	163	183	203	224	
215	244	264	284	304	325	345	365	385	405	425	19 2 2 4 4 8 8 10 10 12 12 14 14 16 16 18 18
216	445	465	486	506	526	546	566	586	606	626	
217	646	666	686	706	726	746	766	786	806	826	
218	846	866	885	905	925	945	965	985	*005	*025	
219	34 044	064	084	104	124	143	163	183	203	223	
220	242	262	282	301	321	341	361	380	400	420	19 2 2 4 4 8 8 10 10 11 11 13 13 15 15 17 17
221	439	459	479	498	518	537	557	577	596	616	
222	635	655	674	694	713	733	753	772	792	811	
223	830	850	869	889	908	928	947	967	986	*005	
224	35 025	044	064	083	102	122	141	160	180	199	
225	218	238	257	276	295	315	334	353	372	392	18 2 2 4 4 7 7 9 9 11 11 13 13 15 15 17 17
226	411	430	449	468	488	507	526	545	564	583	
227	603	622	641	660	679	698	717	736	755	774	
228	793	813	832	851	870	889	908	927	946	965	
229	984	*003	*021	*040	*059	*078	*097	*116	*135	*154	
230	36 173	192	211	229	248	267	286	305	324	342	18 2 2 4 4 7 7 9 9 11 11 13 13 15 15 17 17
231	361	380	399	418	436	455	474	493	511	530	
232	549	568	586	605	624	642	661	680	698	717	
233	736	754	773	791	810	829	847	866	884	903	
234	922	940	959	977	996	*014	*033	*051	*070	*088	
235	37 107	125	144	162	181	199	218	236	254	273	17 2 2 3 3 5 5 7 7 9 9 11 11 13 13 14 14 16 16
236	291	310	328	346	365	383	401	420	438	457	
237	475	493	511	530	548	566	585	603	621	639	
238	658	676	694	712	731	749	767	785	803	822	
239	840	858	876	894	912	931	949	967	985	*003	
240	38 021	039	057	075	093	112	130	148	166	184	17 2 2 3 3 5 5 7 7 9 9 10 10 12 12 14 14 15 15
241	202	220	238	256	274	292	310	328	346	364	
242	382	399	417	435	453	471	489	507	525	543	
243	561	578	596	614	632	650	668	686	703	721	
244	739	757	775	792	810	828	846	863	881	899	
245	917	934	952	970	987	*005	*023	*041	*058	*076	17 2 2 3 3 5 5 7 7 9 9 10 10 12 12 14 14 15 15
246	39 094	111	129	146	164	182	199	217	235	252	
247	270	287	305	322	340	358	375	393	410	428	
248	445	463	480	498	515	533	550	568	585	602	
249	620	637	655	672	690	707	724	742	759	777	
N.	0	1	2	3	4	5	6	7	8	9	P. P.

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N.	0	1	2	3	4	5	6	7	8	9	P. P.	
250	39	794	811	829	846	863	881	898	915	933	950	18
251		967	985	*002	*019	*037	*054	*071	*088	*106	*123	1
252	40	140	157	175	192	209	226	243	261	278	295	2
253		312	329	346	364	381	398	415	432	449	466	3
254		483	500	518	535	552	569	586	603	620	637	4
255		654	671	688	705	722	739	756	773	790	807	5
256		824	841	858	875	892	909	926	943	960	976	6
257		993	*010	*027	*044	*061	*078	*095	*111	*128	*145	7
258	41	162	179	196	212	229	246	263	280	296	313	8
259		330	347	363	380	397	414	430	447	464	481	9
260		497	514	531	547	564	581	597	614	631	647	17
261		664	681	697	714	731	747	764	780	797	814	1
262		830	847	863	880	896	913	929	946	963	979	2
263		996	*012	*029	*045	*062	*078	*095	*111	*127	*144	3
264	42	160	177	193	210	226	243	259	275	292	308	4
265		325	341	357	374	390	406	423	439	455	472	5
266		488	504	521	537	553	570	586	602	619	635	6
267		651	667	684	700	716	732	749	765	781	797	7
268		813	830	846	862	878	894	911	927	943	959	8
269		975	991	*008	*024	*040	*056	*072	*088	*104	*120	9
270	43	136	152	169	185	201	217	233	249	265	281	16
271		297	313	329	345	361	377	393	409	425	441	1
272		457	473	489	505	521	537	553	569	584	600	2
273		616	632	648	664	680	696	712	727	743	759	3
274		775	791	807	823	838	854	870	886	902	917	4
275		933	949	965	981	996	*012	*028	*044	*059	*075	5
276	44	091	107	122	138	154	170	185	201	217	232	6
277		248	264	279	295	311	326	342	358	373	389	7
278		404	420	436	451	467	483	498	514	529	545	8
279		560	576	592	607	623	638	654	669	685	700	9
280		716	731	747	762	778	793	809	824	840	855	15
281		871	886	902	917	932	948	963	979	994	*010	1
282	45	025	040	056	071	086	102	117	133	148	163	2
283		179	194	209	225	240	255	271	286	301	317	3
284		332	347	362	378	393	408	423	439	454	469	4
285		484	500	515	530	545	561	576	591	606	621	5
286		637	652	667	682	697	712	728	743	758	773	6
287		788	803	818	834	849	864	879	894	909	924	7
288		939	954	969	984	*000	*015	*030	*045	*060	*075	8
289	46	090	105	120	135	150	165	180	195	210	225	9
290		240	255	270	285	300	315	330	345	359	374	14
291		389	404	419	434	449	464	479	494	509	523	1
292		538	553	568	583	598	613	627	642	657	672	2
293		687	702	716	731	746	761	776	790	805	820	3
294		835	850	864	879	894	909	923	938	953	967	4
295		982	997	*012	*026	*041	*056	*070	*085	*100	*114	5
296	47	120	144	159	173	188	202	217	232	246	261	6
297		276	290	305	319	334	349	363	378	392	407	7
298		422	436	451	465	480	494	509	524	538	553	8
299		567	582	596	611	625	640	654	669	683	698	9
N.	0	1	2	3	4	5	6	7	8	9	P. P.	

N.	0 1 2 3 4					5 6 7 8 9					P. P.		
300	48	47	71 ²	72 ⁷	74 ¹	75 ⁶	77 ⁰	78 ⁴	79 ⁹	81 ³	82 ⁸	84 ²	15 2 3 4 5 6 7 8 9
301		85 ⁷	87 ¹	88 ⁵	90 ⁰	91 ⁴	92 ⁹	94 ³	95 ⁸	97 ²	98 ⁶		
302		00 ¹	01 ⁵	02 ⁹	04 ⁴	05 ⁸	07 ³	08 ⁷	10 ¹	11 ⁶	13 ⁰		
303		14 ⁴	15 ⁹	17 ³	18 ⁷	20 ²	21 ⁶	23 ⁰	24 ⁴	25 ⁹	27 ³		
304		28 ⁷	30 ²	31 ⁶	33 ⁰	34 ⁴	35 ⁹	37 ³	38 ⁷	40 ¹	41 ⁶		
305	50	43 ⁰	44 ⁴	45 ⁸	47 ³	48 ⁷	50 ¹	51 ⁵	53 ⁰	54 ⁴	55 ⁸	9 11 12 14	
306		57 ²	58 ⁶	60 ¹	61 ⁵	62 ⁹	64 ³	65 ⁷	67 ¹	68 ⁶	70 ⁰		
307		71 ⁴	72 ⁸	74 ²	75 ⁶	77 ⁰	78 ⁵	79 ⁹	81 ³	82 ⁷	84 ¹		
308		85 ⁵	86 ⁹	88 ³	89 ⁷	91 ¹	92 ⁶	94 ⁰	95 ⁴	96 ⁸	98 ²		
309		99 ⁶	*01 ⁰	*02 ⁴	*03 ⁸	*05 ²	*06 ⁶	*08 ⁰	*09 ⁴	*10 ⁸	*12 ²		
310	49	13 ⁶	15 ⁰	16 ⁴	17 ⁸	19 ²	20 ⁶	22 ⁰	23 ⁴	24 ⁸	26 ²	14 1 2 3 4 5 6 7 8 9	
311		27 ⁶	29 ⁰	30 ⁴	31 ⁸	33 ²	34 ⁶	36 ⁰	37 ⁴	38 ⁸	40 ²		
312		41 ⁵	42 ⁹	44 ³	45 ⁷	47 ¹	48 ⁵	49 ⁹	51 ³	52 ⁷	54 ¹		
313		55 ⁴	56 ⁸	58 ²	59 ⁶	61 ⁰	62 ⁴	63 ⁸	65 ¹	66 ⁵	67 ⁹		
314		69 ³	70 ⁷	72 ¹	73 ⁴	74 ⁸	76 ²	77 ⁶	79 ⁰	80 ³	81 ⁷		
315	50	83 ¹	84 ⁵	85 ⁹	87 ²	88 ⁶	90 ⁰	91 ⁴	92 ⁷	94 ¹	95 ⁵	10 11 13	
316		99 ⁹	98 ²	99 ⁶	*01 ⁰	*02 ⁴	*03 ⁷	*05 ¹	*06 ⁵	*07 ⁹	*09 ²		
317		106 ¹	120 ¹	133 ¹	147 ¹	161 ¹	174 ¹	188 ²	202 ²	215 ²	229 ²		
318		243 ²	256 ²	270 ²	284 ²	297 ²	311 ²	325 ²	338 ²	352 ²	365 ²		
319		379 ²	393 ²	406 ²	420 ²	433 ²	447 ²	461 ²	474 ²	488 ²	501 ²		
320	51	51 ⁵	52 ⁹	54 ²	55 ⁶	56 ⁹	58 ³	59 ⁶	61 ⁰	62 ³	63 ⁷	13 1 2 3 4 5 6 7 8 9	
321		65 ¹	66 ⁴	67 ⁸	69 ¹	70 ⁵	71 ⁸	73 ²	74 ⁵	75 ⁹	77 ²		
322		78 ⁶	79 ⁹	81 ³	82 ⁶	84 ⁰	85 ³	86 ⁶	88 ⁰	89 ³	90 ⁷		
323		92 ⁰	93 ⁴	94 ⁷	96 ¹	97 ⁴	98 ⁷	*00 ¹	*01 ⁴	*02 ⁸	*04 ¹		
324		05 ⁵	06 ⁸	08 ¹	09 ⁵	10 ⁸	12 ¹	13 ⁵	14 ⁸	16 ²	17 ⁵		
325	52	18 ⁸	20 ²	21 ⁵	22 ⁸	24 ²	25 ⁵	26 ⁸	28 ²	29 ⁵	30 ⁸	14 1 2 3 4 5 6 7 8 9	
326		32 ²	33 ⁵	34 ⁸	36 ²	37 ⁵	38 ⁸	40 ²	41 ⁵	42 ⁸	44 ¹		
327		45 ⁵	46 ⁸	48 ¹	49 ⁵	50 ⁸	52 ¹	53 ⁴	54 ⁸	56 ¹	57 ⁴		
328		58 ⁷	60 ¹	61 ⁴	62 ⁷	64 ⁰	65 ⁴	66 ⁷	68 ⁰	69 ³	70 ⁶		
329		72 ⁰	73 ³	74 ⁶	75 ⁹	77 ²	78 ⁶	79 ⁹	81 ²	82 ⁵	83 ⁸		
330	53	85 ¹	86 ⁵	87 ⁸	89 ¹	90 ⁴	91 ⁷	93 ⁰	94 ³	95 ⁷	97 ⁰	12 1 2 3 4 5 6 7 8 9	
331		98 ³	99 ⁶	*00 ⁹	*02 ²	*03 ⁵	*04 ⁸	*06 ¹	*07 ⁵	*08 ⁸	*10 ¹		
332		114 ¹	127 ¹	140 ¹	153 ¹	166 ¹	179 ¹	192 ¹	205 ¹	218 ¹	231 ¹		
333		244 ¹	257 ¹	270 ¹	284 ¹	297 ¹	310 ¹	323 ¹	336 ¹	349 ¹	362 ¹		
334		375 ¹	388 ¹	401 ¹	414 ¹	427 ¹	440 ¹	453 ¹	466 ¹	479 ¹	492 ¹		
335	54	50 ⁴	51 ⁷	53 ⁰	54 ³	55 ⁶	56 ⁹	58 ²	59 ⁵	60 ⁸	62 ¹	11 1 2 3 4 5 6 7 8 9	
336		63 ⁴	64 ⁷	66 ⁰	67 ³	68 ⁶	69 ⁹	71 ¹	72 ⁴	73 ⁷	75 ⁰		
337		76 ³	77 ⁶	78 ⁹	80 ²	81 ⁵	82 ⁷	84 ⁰	85 ³	86 ⁶	87 ⁹		
338		89 ²	90 ⁵	91 ⁷	93 ⁰	94 ³	95 ⁶	96 ⁹	98 ²	99 ⁴	*00 ⁷		
339		02 ⁰	03 ³	04 ⁶	05 ⁸	07 ¹	08 ⁴	09 ⁷	11 ⁰	12 ²	13 ⁵		
340	55	14 ⁸	16 ¹	17 ³	18 ⁶	19 ⁹	21 ²	22 ⁴	23 ⁷	25 ⁰	26 ³	12 1 2 3 4 5 6 7 8 9	
341		27 ⁵	28 ⁸	30 ¹	31 ⁴	32 ⁶	33 ⁹	35 ²	36 ⁴	37 ⁷	39 ⁰		
342		40 ³	41 ⁵	42 ⁸	44 ¹	45 ³	46 ⁶	47 ⁹	49 ¹	50 ⁴	51 ⁷		
343		52 ⁹	54 ²	55 ⁵	56 ⁷	58 ⁰	59 ³	60 ⁵	61 ⁸	63 ¹	64 ³		
344		65 ⁶	66 ⁸	68 ¹	69 ⁴	70 ⁶	71 ⁹	73 ²	74 ⁴	75 ⁷	76 ⁹		
345	56	78 ²	79 ⁴	80 ⁷	82 ⁰	83 ²	84 ⁵	85 ⁷	87 ⁰	88 ²	89 ⁵	11 1 2 3 4 5 6 7 8 9	
346		90 ⁸	92 ⁰	93 ³	94 ⁵	95 ⁸	97 ⁰	98 ³	99 ⁵	*00 ⁸	*02 ⁰		
347		03 ³	04 ⁵	05 ⁸	07 ⁰	08 ³	09 ⁵	10 ⁸	12 ⁰	13 ³	14 ⁵		
348		15 ⁸	17 ⁰	18 ³	19 ⁵	20 ⁸	22 ⁰	23 ³	24 ⁵	25 ⁸	27 ⁰		
349		28 ³	29 ⁵	30 ⁷	32 ⁰	33 ²	34 ⁵	35 ⁷	37 ⁰	38 ²	39 ⁴		
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350	54 407	419	432	444	456	469	481	494	506	518	13 1
351	531	543	555	568	580	593	605	617	630	642	
352	654	667	679	691	704	716	728	741	753	765	
353	777	790	802	814	827	839	851	864	876	888	
354	900	913	925	937	949	962	974	986	998	*011	
355	55 023	035	047	060	072	084	096	108	121	133	4 5
356	145	157	169	182	194	206	218	230	242	255	
357	267	279	291	303	315	328	340	352	364	376	
358	388	400	413	425	437	449	461	473	485	497	
359	509	522	534	546	558	570	582	594	606	618	
360	630	642	654	666	678	691	703	715	727	739	8 9
361	751	763	775	787	799	811	823	835	847	859	
362	871	883	895	907	919	931	943	955	967	979	
363	991	*003	*015	*027	*038	*050	*062	*074	*086	*098	
364	56 110	122	134	146	158	170	182	194	205	217	
365	229	241	253	265	277	289	301	312	324	336	12 1
366	348	360	372	384	396	407	419	431	443	455	
367	467	478	490	502	514	526	538	549	561	573	
368	585	597	608	620	632	644	656	667	679	691	
369	703	714	726	738	750	761	773	785	797	808	
370	820	832	844	855	867	879	891	902	914	926	10 11
371	937	949	961	972	984	996	*008	*019	*031	*043	
372	57 054	066	078	089	101	113	124	136	148	159	
373	171	183	194	206	217	229	241	252	264	276	
374	287	299	310	322	334	345	357	368	380	392	
375	403	415	426	438	449	461	473	484	496	507	11 1
376	519	530	542	553	565	576	588	600	611	623	
377	634	646	657	669	680	692	703	715	726	738	
378	749	761	772	784	795	807	818	830	841	852	
379	864	875	887	898	910	921	933	944	955	967	
380	978	990	*001	*013	*024	*035	*047	*058	*070	*081	3 4
381	58 092	104	115	127	138	149	161	172	184	195	
382	206	218	229	240	252	263	274	286	297	309	
383	320	331	343	354	365	377	388	399	410	422	
384	433	444	456	467	478	490	501	512	524	535	
385	546	557	569	580	591	602	614	625	636	647	5 6
386	659	670	681	692	704	715	726	737	749	760	
387	771	782	794	805	816	827	838	850	861	872	
388	883	894	906	917	928	939	950	961	973	984	
389	995	*006	*017	*028	*040	*051	*062	*073	*084	*095	
390	59 106	118	129	140	151	162	173	184	195	207	10 1
391	218	229	240	251	262	273	284	295	306	318	
392	329	340	351	362	373	384	395	406	417	428	
393	439	450	461	472	483	494	506	517	528	539	
394	550	561	572	583	594	605	616	627	638	649	
395	660	671	682	693	704	715	726	737	748	759	7 8
396	770	780	791	802	813	824	835	846	857	868	
397	879	890	901	912	923	934	945	956	966	977	
398	988	999	*010	*021	*032	*043	*054	*065	*076	*086	
399	60 097	108	119	130	141	152	163	173	184	195	
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400	60 206	217	228	239	249	260	271	282	293	304	11 1 2 3 4 5 6 7 8 9 10

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450	65	321	331	341	350	360	369	379	389	398	408
451		418	427	437	447	456	466	475	485	495	504
452		514	523	533	543	552	562	571	581	591	600
453		610	619	629	639	648	658	667	677	686	696
454		706	715	725	734	744	753	763	772	782	792
455		801	811	820	830	839	849	858	868	877	887
456		896	906	916	925	935	944	954	963	973	982
457		992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66	087	096	106	115	124	134	143	153	162	172
459		181	191	200	210	219	229	238	247	257	266
460		276	285	295	304	314	323	332	342	351	361
461		370	380	389	398	408	417	427	436	445	455
462		464	474	483	492	502	511	521	530	539	549
463		558	567	577	586	596	605	614	624	633	642
464		652	661	671	680	689	699	708	717	727	736
465		745	755	764	773	783	792	801	811	820	829
466		839	848	857	867	876	885	894	904	913	922
467		932	941	950	960	969	978	987	997	*006	*015
468	67	025	034	043	052	062	071	080	089	099	108
469		117	127	136	145	154	164	173	182	191	201
470		210	219	228	237	247	256	265	274	284	293
471		302	311	321	330	339	348	357	367	376	385
472		394	403	413	422	431	440	449	459	468	477
473		486	495	504	514	523	532	541	550	560	569
474		578	587	596	605	614	624	633	642	651	660
475		669	679	688	697	706	715	724	733	742	752
476		761	770	779	788	797	806	815	825	834	843
477		852	861	870	879	888	897	906	916	925	934
478		943	952	961	970	979	988	997	*006	*015	*024
479	68	034	043	052	061	070	079	088	097	106	115
480		124	133	142	151	160	169	178	187	196	205
481		215	224	233	242	251	260	269	278	287	296
482		305	314	323	332	341	350	359	368	377	386
483		395	404	413	422	431	440	449	458	467	476
484		485	494	502	511	520	529	538	547	556	565
485		574	583	592	601	610	619	628	637	646	655
486		664	673	681	690	699	708	717	726	735	744
487		753	762	771	780	789	797	806	815	824	833
488		842	851	860	869	878	886	895	904	913	922
489		931	940	949	958	966	975	984	993	*002	*011
490	69	020	028	037	046	055	064	073	082	090	099
491		108	117	126	135	144	152	161	170	179	188
492		197	205	214	223	232	241	249	258	267	276
493		285	294	302	311	320	329	338	346	355	364
494		373	381	390	399	408	417	425	434	443	452
495		461	469	478	487	496	504	513	522	531	539
496		548	557	566	574	583	592	601	609	618	627
497		636	644	653	662	671	679	688	697	705	714
498		723	732	740	749	758	767	775	784	793	801
499		810	819	827	836	845	854	862	871	880	888
N.	0	1	2	3	4	5	6	7	8	9	P. P.

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500	69 897	906	914	923	932	940	949	958	966	975	1 9
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062	
502	70 070	079	088	096	105	114	122	131	140	148	
503	157	165	174	183	191	200	209	217	226	234	
504	243	252	260	269	278	286	295	303	312	321	
505	329	338	346	355	364	372	381	389	398	406	1 9
506	415	424	432	441	449	458	467	475	484	492	
507	501	509	518	526	535	544	552	561	569	578	
508	586	595	603	612	621	629	638	646	655	663	
509	672	680	689	697	706	714	723	731	740	749	
510	757	766	774	783	791	800	808	817	825	834	1 9
511	842	851	859	868	876	885	893	902	910	919	
512	927	935	944	952	961	969	978	986	995	*003	
513	71 012	020	029	037	046	054	063	071	079	088	
514	096	105	113	122	130	139	147	155	164	172	
515	181	189	198	206	214	223	231	240	248	257	1 9
516	265	273	282	290	299	307	315	324	332	341	
517	349	357	366	374	383	391	399	408	416	425	
518	433	441	450	458	466	475	483	492	500	508	
519	517	525	533	542	550	559	567	575	584	592	
520	600	609	617	625	634	642	650	659	667	675	1 9
521	684	692	700	709	717	725	734	742	750	759	
522	767	775	784	792	800	809	817	825	834	842	
523	850	858	867	875	883	892	900	908	917	925	
524	933	941	950	958	966	975	983	991	999	*008	
525	72 016	024	032	041	049	057	066	074	082	090	1 9
526	099	107	115	123	132	140	148	156	165	173	
527	181	189	198	206	214	222	230	239	247	255	
528	263	272	280	288	296	304	313	321	329	337	
529	346	354	362	370	378	387	395	403	411	419	
530	428	436	444	452	460	469	477	485	493	501	1 9
531	509	518	526	534	542	550	558	567	575	583	
532	591	599	607	616	624	632	640	648	656	665	
533	673	681	689	697	705	713	722	730	738	746	
534	754	762	770	779	787	795	803	811	819	827	
535	835	843	852	860	868	876	884	892	900	908	1 9
536	916	925	933	941	949	957	965	973	981	989	
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070	
538	73 078	086	094	102	111	119	127	135	143	151	
539	159	167	175	183	191	199	207	215	223	231	
540	239	247	255	263	272	280	288	296	304	312	1 9
541	320	328	336	344	352	360	368	376	384	392	
542	400	408	416	424	432	440	448	456	464	472	
543	480	488	496	504	512	520	528	536	544	552	
544	560	568	576	584	592	600	608	616	624	632	
545	640	648	656	664	672	679	687	695	703	711	1 9
546	719	727	735	743	751	759	767	775	783	791	
547	799	807	815	823	830	838	846	854	862	870	
548	878	886	894	902	910	918	926	933	941	949	
549	957	965	973	981	989	997	*005	*013	*020	*028	
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550	74 036	044	052	060	068	076	084	092	099	107	8 1 2 3 4 5 6 7

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N.	0	1	2	3	4	5	6	7	8	9	P. P.
600	77 815	822	830	837	844	851	859	866	873	880	1 2 3 4 5 6 7 8 9
601	887	895	902	909	916	924	931	938	945	952	
602	960	967	974	981	988	996	*003	*010	*017	*025	
603	78 032	039	046	053	061	068	075	082	089	097	
604	104	111	118	125	132	140	147	154	161	168	
605	176	183	190	197	204	211	219	226	233	240	
606	247	254	262	269	276	283	290	297	305	312	
607	319	326	333	340	347	355	362	369	376	383	
608	390	398	405	412	419	426	433	440	447	455	
609	462	469	476	483	490	497	504	512	519	526	
610	533	540	547	554	561	569	576	583	590	597	1 2 3 4 5 6 7 8 9
611	604	611	618	625	633	640	647	654	661	668	
612	675	682	689	696	704	711	718	725	732	739	
613	746	753	760	767	774	781	789	796	803	810	
614	817	824	831	838	845	852	859	866	873	880	
615	888	895	902	909	916	923	930	937	944	951	
616	958	965	972	979	986	993	*000	*007	*014	*021	
617	79 029	036	043	050	057	064	071	078	085	092	
618	099	106	113	120	127	134	141	148	155	162	
619	169	176	183	190	197	204	211	218	225	232	
620	239	246	253	260	267	274	281	288	295	302	1 2 3 4 5 6 7 8 9
621	309	316	323	330	337	344	351	358	365	372	
622	379	386	393	400	407	414	421	428	435	442	
623	449	456	463	470	477	484	491	498	505	511	
624	518	525	532	539	546	553	560	567	574	581	
625	588	595	602	609	616	623	630	637	644	650	
626	657	664	671	678	685	692	699	706	713	720	
627	727	734	741	748	754	761	768	775	782	789	
628	796	803	810	817	824	831	837	844	851	858	
629	865	872	879	886	893	900	906	913	920	927	
630	934	941	948	955	962	969	975	982	989	996	1 2 3 4 5 6 7 8 9
631	80 003	010	017	024	030	037	044	051	058	065	
632	072	079	085	092	099	106	113	120	127	134	
633	140	147	154	161	168	175	182	188	195	202	
634	209	216	223	229	236	243	250	257	264	271	
635	277	284	291	298	305	312	318	325	332	339	
636	346	353	359	366	373	380	387	393	400	407	
637	414	421	428	434	441	448	455	462	468	475	
638	482	489	496	502	509	516	523	530	536	543	
639	550	557	564	570	577	584	591	598	604	611	
640	618	625	632	638	645	652	659	665	672	679	1 2 3 4 5 6 7 8 9
641	686	693	699	706	713	720	726	733	740	747	
642	754	760	767	774	781	787	794	801	808	814	
643	821	828	835	841	848	855	862	868	875	882	
644	889	895	902	909	916	922	929	936	943	949	
645	956	963	969	976	983	990	996	*003	*010	*017	
646	81 023	030	037	043	050	057	064	070	077	084	
647	090	097	104	111	117	124	131	137	144	151	
648	158	164	171	178	184	191	198	204	211	218	
649	224	231	238	245	251	258	265	271	278	285	
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650	81 291	298	305	311	318	325	331	338	345	351	1 2 3 4 5 6 7 8 9 7 1 2 3 4 4 5 6
651	358	365	371	378	385	391	398	405	411	418	
652	425	431	438	445	451	458	465	471	478	485	
653	491	498	505	511	518	525	531	538	544	551	
654	558	564	571	578	584	591	598	604	611	617	
655	624	631	637	644	651	657	664	671	677	684	
656	690	697	704	710	717	723	730	737	743	750	
657	757	763	770	776	783	790	796	803	809	816	
658	823	829	836	842	849	856	862	869	875	882	
659	889	895	902	908	915	921	928	935	941	948	
660	954	961	968	974	981	987	994	*000	*007	*014	
661	82 020	027	033	040	046	053	060	066	073	079	
662	086	092	099	105	112	119	125	132	138	145	
663	151	158	164	171	178	184	191	197	204	210	
664	217	223	230	236	243	249	256	263	269	276	
665	282	289	295	302	308	315	321	328	334	341	
666	347	354	360	367	373	380	387	393	400	406	
667	413	419	426	432	439	445	452	458	465	471	
668	478	484	491	497	504	510	517	523	530	536	
669	543	549	556	562	569	575	582	588	595	601	
670	607	614	620	627	633	640	646	653	659	666	
671	672	679	685	692	698	705	711	718	724	730	
672	737	743	750	756	763	769	776	782	789	795	
673	802	808	814	821	827	834	840	847	853	860	
674	866	872	879	885	892	898	905	911	918	924	
675	930	937	943	950	956	963	969	975	982	988	
676	995	*001	*008	*014	*020	*027	*033	*040	*046	*052	
677	83 059	065	072	078	085	091	097	104	110	117	
678	123	129	136	142	149	155	161	168	174	181	
679	187	193	200	206	213	219	225	232	238	245	
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681	315	321	327	334	340	347	353	359	366	372	
682	378	385	391	398	404	410	417	423	429	436	
683	442	448	455	461	467	474	480	487	493	499	
684	506	512	518	525	531	537	544	550	556	563	
685	569	575	582	588	594	601	607	613	620	626	
686	632	639	645	651	658	664	670	677	683	689	
687	696	702	708	715	721	727	734	740	746	753	
688	759	765	771	778	784	790	797	803	809	816	
689	822	828	835	841	847	853	860	866	872	879	
690	885	891	897	904	910	916	923	929	935	942	
691	948	954	960	967	973	979	985	992	998	*004	
692	84 011	017	023	029	036	042	048	055	061	067	
693	073	080	086	092	098	105	111	117	123	130	
694	136	142	148	155	161	167	173	180	186	192	
695	198	205	211	217	223	230	236	242	248	255	
696	261	267	273	280	286	292	298	305	311	317	
697	323	330	336	342	348	354	361	367	373	379	
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702	634	640	646	652	658	665	671	677	683	689	
703	696	702	708	714	720	726	733	739	745	751	
704	757	763	770	776	782	788	794	800	807	813	
705	819	825	831	837	844	850	856	862	868	874	1 2 3 4 5 6 7 8 9
706	880	887	893	899	905	911	917	924	930	936	
707	942	948	954	960	967	973	979	985	991	997	
708	85 003	009	016	022	028	034	040	046	052	058	
709	065	071	077	083	089	095	101	107	114	120	
710	126	132	138	144	150	156	163	169	175	181	1 2 3 4 5 6 7 8 9
711	187	193	199	205	211	217	224	230	236	242	
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713	309	315	321	327	333	339	345	352	358	364	
714	370	376	382	388	394	400	406	412	418	425	
715	431	437	443	449	455	461	467	473	479	485	1 2 3 4 5 6 7 8 9
716	491	497	503	509	516	522	528	534	540	546	
717	552	558	564	570	576	582	588	594	600	606	
718	612	618	625	631	637	643	649	655	661	667	
719	673	679	685	691	697	703	709	715	721	727	
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721	794	800	806	812	818	824	830	836	842	848	
722	854	860	866	872	878	884	890	896	902	908	
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729	273	279	285	291	297	303	308	314	320	326	
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731	392	398	404	410	415	421	427	433	439	445	
732	451	457	463	469	475	481	487	493	499	504	
733	510	516	522	528	534	540	546	552	558	564	
734	570	576	581	587	593	599	605	611	617	623	
735	629	635	641	646	652	658	664	670	676	682	1 2 3 4 5 6 7 8 9
736	688	694	700	705	711	717	723	729	735	741	
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738	806	812	817	823	829	835	841	847	853	859	
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741	982	988	994	999	*005	*011	*017	*023	*029	*035	
742	87 040	046	052	058	064	070	075	081	087	093	
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744	157	163	169	175	181	186	192	198	204	210	
745	216	221	227	233	239	245	251	256	262	268	1 2 3 4 5 6 7 8 9
746	274	280	286	291	297	303	309	315	320	326	
747	332	338	344	349	355	361	367	373	379	384	
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753	679	685	691	697	703	708	714	720	726	731	
754	737	743	749	754	760	766	772	777	783	789	
755	795	800	806	812	818	823	829	835	841	846	
756	852	858	864	869	875	881	887	892	898	904	
757	910	915	921	927	933	938	944	950	955	961	
758	967	973	978	984	990	996	*001	*007	*013	*018	
759	88 024	030	036	041	047	053	058	064	070	076	
760	081	087	093	098	104	110	116	121	127	133	
761	138	144	150	156	161	167	173	178	184	190	
762	195	201	207	213	218	224	230	235	241	247	
763	252	258	264	270	275	281	287	292	298	304	
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765	366	372	377	383	389	395	400	406	412	417	
766	423	429	434	440	446	451	457	463	468	474	
767	480	485	491	497	502	508	513	519	525	530	
768	536	542	547	553	559	564	570	576	581	587	
769	593	598	604	610	615	621	627	632	638	643	
770	649	655	660	666	672	677	683	689	694	700	
771	705	711	717	722	728	734	739	745	750	756	
772	762	767	773	779	784	790	795	801	807	812	
773	818	824	829	835	840	846	852	857	863	868	
774	874	880	885	891	897	902	908	913	919	925	
775	930	936	941	947	953	958	964	969	975	981	
776	986	992	997	*003	*009	*014	*020	*025	*031	*037	
777	89 042	048	053	059	064	070	076	081	087	092	
778	098	104	109	115	120	126	131	137	143	148	
779	154	159	165	170	176	182	187	193	198	204	
780	209	215	221	226	232	237	243	248	254	260	
781	265	271	276	282	287	293	298	304	310	315	
782	321	326	332	337	343	348	354	360	365	371	
783	376	382	387	393	398	404	409	415	421	426	
784	432	437	443	448	454	459	465	470	476	481	
785	487	492	498	504	509	515	520	526	531	537	
786	542	548	553	559	564	570	575	581	586	592	
787	597	603	609	614	620	625	631	636	642	647	
788	653	658	664	669	675	680	686	691	697	702	
789	708	713	719	724	730	735	741	746	752	757	
790	763	768	774	779	785	790	796	801	807	812	
791	818	823	829	834	840	845	851	856	862	867	
792	873	878	883	889	894	900	905	911	916	922	
793	927	933	938	944	949	955	960	966	971	977	
794	982	988	993	998	*004	*009	*015	*020	*026	*031	
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796	091	097	102	108	113	119	124	129	135	140	
797	146	151	157	162	168	173	179	184	189	195	
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804	526	531	536	542	547	553	558	563	569	574	
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807	687	693	698	703	709	714	720	725	730	736	
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814	062	068	073	078	084	089	094	100	105	110	
815	116	121	126	132	137	142	148	153	158	164	
816	169	174	180	185	190	196	201	206	212	217	
817	222	228	233	238	243	249	254	259	265	270	
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819	328	334	339	344	350	355	360	365	371	376	
820	381	387	392	397	403	408	413	418	424	429	
821	434	440	445	450	455	461	466	471	477	482	
822	487	492	498	503	508	514	519	524	529	535	
823	540	545	551	556	561	566	572	577	582	587	
824	593	598	603	609	614	619	624	630	635	640	
825	645	651	656	661	666	672	677	682	687	693	
826	698	703	709	714	719	724	730	735	740	745	
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829	855	861	866	871	876	882	887	892	897	903	
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833	065	070	075	080	085	091	096	101	106	111	
834	117	122	127	132	137	143	148	153	158	163	
835	169	174	179	184	189	195	200	205	210	215	
836	221	226	231	236	241	247	252	257	262	267	
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839	376	381	387	392	397	402	407	412	418	423	
840	428	433	438	443	449	454	459	464	469	474	
841	480	485	490	495	500	505	511	516	521	526	
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858		349	354	359	364	369	374	379	384	389	394		
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861		500	505	510	515	520	526	531	536	541	546		
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871	94	002	007	012	017	022	027	032	037	042	047		
872		052	057	062	067	072	077	082	086	091	096		
873		101	106	111	116	121	126	131	136	141	146		
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876		250	255	260	265	270	275	280	285	290	295		
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880		448	453	458	463	468	473	478	483	488	493	1 2 3 4 5 6 7 8 9	4 0 1 1 2 2 3 3 4
881		498	503	507	512	517	522	527	532	537	542		
882		547	552	557	562	567	571	576	581	586	591		
883		596	601	606	611	616	621	626	630	635	640		
884		645	650	655	660	665	670	675	680	685	689		
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896		231	236	240	245	250	255	260	265	270	274		
897		279	284	289	294	299	303	308	313	318	323		
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899		376	381	386	390	395	400	405	410	415	419		
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901	472	477	482	487	492	497	501	506	511	516	
902	521	525	530	535	540	545	550	554	559	564	
903	569	574	578	583	588	593	598	602	607	612	
904	617	622	626	631	636	641	646	650	655	660	5 1 1 2 2 3 3 4 4 5
905	665	670	674	679	684	689	694	698	703	708	
906	713	718	722	727	732	737	742	746	751	756	
907	761	766	770	775	780	785	789	794	799	804	
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909	856	861	866	871	875	880	885	890	895	899	
910	904	909	914	918	923	928	933	938	942	947	
911	952	957	961	966	971	976	980	985	990	995	
912	999	*004	*009	*014	*019	*023	*028	*033	*038	*042	4 0 1 1 2 2 3 3 4
913	96	047	052	057	061	071	076	080	085	090	
914	095	099	104	109	114	118	123	128	133	137	
915	142	147	152	156	161	166	171	175	180	185	
916	190	194	199	204	209	213	218	223	227	232	1 2 3 4 5 6 7 8 9
917	237	242	246	251	256	261	265	270	275	280	
918	284	289	294	298	303	308	313	317	322	327	
919	332	336	341	346	350	355	360	365	369	374	
920	379	384	388	393	398	402	407	412	417	421	1 2 3 4 5 6 7 8 9
921	426	431	435	440	445	450	454	459	464	468	
922	473	478	483	487	492	497	501	506	511	515	
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926	661	666	670	675	680	685	689	694	699	703	
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929	802	806	811	816	820	825	830	834	839	844	
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931	895	900	904	909	914	918	923	928	932	937	
932	942	946	951	956	960	965	970	974	979	984	4 0 1 1 2 2 3 3 4
933	988	993	997	*002	*007	*011	*016	*021	*025	*030	
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935	081	086	090	095	100	104	109	114	118	123	
936	128	132	137	142	146	151	155	160	165	169	1 2 3 4 5 6 7 8 9
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938	220	225	230	234	239	243	248	253	257	262	
939	267	271	276	280	285	290	294	299	304	308	
940	313	317	322	327	331	336	340	345	350	354	1 2 3 4 5 6 7 8 9
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	4 0 1 1 2 2 3 3 4
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	1 2 3 4 5 6 7 8 9
949	727	731	736	740	745	749	754	759	763	768	
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951	818	823	827	832	836	841	845	850	855	859	
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956	046	050	055	059	064	068	073	078	082	087	
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961	272	277	281	286	290	295	299	304	308	313	
962	318	322	327	331	336	340	345	349	354	358	
963	363	367	372	376	381	385	390	394	399	403	
964	408	412	417	421	426	430	435	439	444	448	
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966	498	502	507	511	516	520	525	529	534	538	
967	543	547	552	556	561	565	570	574	579	583	
968	588	592	597	601	605	610	614	619	623	628	
969	632	637	641	646	650	655	659	664	668	673	
970	677	682	686	691	695	700	704	709	713	717	4 0 1 1 2 2 2 3 3 4
971	722	726	731	735	740	744	749	753	758	762	
972	767	771	776	780	784	789	793	798	802	807	
973	811	816	820	825	829	834	838	843	847	851	
974	856	860	865	869	874	878	883	887	892	896	
975	900	905	909	914	918	923	927	932	936	941	1 2 3 4 5 6 7 8 9
976	945	949	954	958	963	967	972	976	981	985	
977	989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99 034	038	043	047	052	056	061	065	069	074	
979	078	083	087	092	096	100	105	109	114	118	
980	123	127	131	136	140	145	149	154	158	162	4 0 1 1 2 2 2 3 3 4
981	167	171	176	180	185	189	193	198	202	207	
982	211	216	220	224	229	233	238	242	247	251	
983	255	260	264	269	273	277	282	286	291	295	
984	300	304	308	313	317	322	326	330	335	339	
985	344	348	352	357	361	366	370	374	379	383	1 2 3 4 5 6 7 8 9
986	388	392	396	401	405	410	414	419	423	427	
987	432	436	441	445	449	454	458	463	467	471	
988	476	480	484	489	493	498	502	506	511	515	
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991	607	612	616	621	625	629	634	638	642	647	
992	651	656	660	664	669	673	677	682	686	691	
993	695	699	704	708	712	717	721	726	730	734	
994	739	743	747	752	756	760	765	769	774	778	
995	782	787	791	795	800	804	808	813	817	822	1 2 3 4 5 6 7 8 9
996	826	830	835	839	843	848	852	856	861	865	
997	870	874	878	883	887	891	896	900	904	909	
998	913	917	922	926	930	935	939	944	948	952	
999	957	961	965	970	974	978	983	987	991	996	
N.	0	1	2	3	4	5	6	7	8	9	P. P.

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